The Foundry

for March

Foundrymen or Salesmen

HOW many salesmen are there in the 5000 foundries of America? How many can any of you foundrymen name? If each of the readers of THE FOUNDRY sent us the names of salesmen in the foundry industry, how long a list would we have? Do any of you know one hundred, a dozen or even five?

You know your competitors. Are their salesmen price cutters? If their presidents, do the selling (so called), are they salesmen? Are their vice-presidents or managers, salesmen?

Would ninety per cent of the foundries be short of money now if they had salesmen? Would everyone else be a price cutter if you were a salesman?

Would there be so many antiquated jobbing shops, so much obsolete equipment, such poor appointments in shops and offices if there were more salesmen?

Would foundry personnel be a low or highly paid class if castings were really sold?

What new or old, but compelling, sales arguments are ever presented to users of castings to get them to buy from you or any other foundry? What do you stress except price?

Is a foundry executive who grew up through the sand pile, coreroom, office, college or entered by inheritance from an ancestor necessarily a salesman? Or is selling castings in the same class as any other line where expert salesmanship is a profession?

If you can answer these questions, we should like to publish your findings.

What They Want

FOUNDRYMEN from abroad are frequent visitors in the offices of this publication. They come from England, Germany, Sweden, Italy, South Africa, India, Australia and elsewhere. They are students of American foundry practice eager to see, study and buy. They make good castings in their homelands, but they want American equipment. From the most costly molding, cleaning or handling equipment to flasks and chaplets, they find means to buy. At home they have high taxes, labor, social and currency troubles. Dizzy laws and queer politics may tangle their manufacturing problems. But they are buying and using better equipment. Should not American foundrymen find encouragement in their example to retool, rebuild and re-equip?

Watching the Human Side

ANNOUNCEMENT of the setup of the safety and hygiene section of the American Foundrymen's association, outlined in brief in February, is a long step forward. It means conservation of manpower by preventing accidents and lost time. It means improvement of working conditions to promote comfort and health. It promises the organization of the entire foundry industry in the interest of employe welfare. These things have been done well in individual plants, among large companies in particular. The active interest of the American Foundrymen's association will accelerate good work, well begun.

Taxes and Castings

TAXES on undistributed earnings proposed to Congress in early March would penalize companies for building reserves. Such taxes would discourage plowing earnings back into plant and equipment. Nothing could do more damage to durable goods recovery. This would hurt the foundry business. Distributed earnings don't pay for castings.

Editor

CALCIMINE And GOOD HOUSEKEEPING

By FRANK G. STEINEBACH

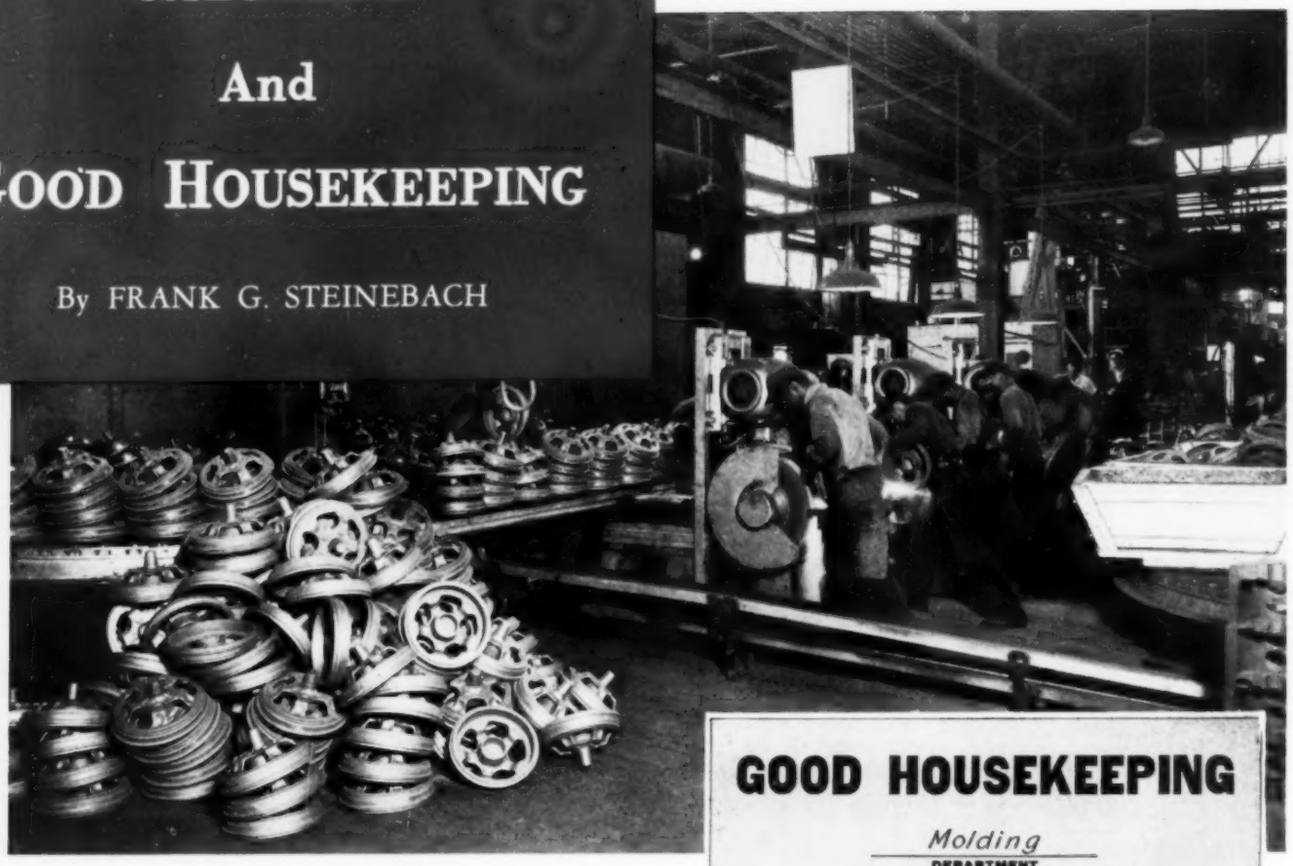


Fig. 1—The foreman is charged with the responsibility of seeing the department is kept clean

Fig. 2—Good housekeeping chart posted in each department. Daily ratings are marked on the chart by the safety inspector

THIS is the story of a large salt shaker, some yellow calcimine and the foreman's wife, and the part each has played in furthering the good housekeeping program of the Campbell, Wyant & Cannon Foundry Co., Muskegon Heights, Mich., one of the fastest moving automotive castings production shops in the country. Founded in 1908 in a small plant having an annual capacity of 1500 tons, the company now operates two large plants in Muskegon Heights with a total capacity of 150,000 tons of finished castings annually, and a plant in South Haven, Mich., having a capacity of 30,000 tons annually.

In April, 1935, when the rising market for automobile castings placed greater demands upon the production capacity of the Campbell, Wyant & Cannon foundries, the management realized the immediate necessity for re-establishing a previously operated good housekeeping program. Several factors influenced the officers of the company in making that decision. Good housekeeping is a prime requisite of any safety program, and with a larger number of employes, the safety work of that company naturally required great attention. An exceptionally large sum is invested in foundry equipment for a wide variety of operations and, of course, to secure maximum production from any of that equipment, it is necessary that the equipment and plant be kept clean and in order at all times.

The first step in the good housekeeping program which, incidentally, is tied in directly with the safety work at the plants, was the education of the foremen. The second step was the education of all the employes of the plant in the absolute need as well as the desirability of good housekeeping. At the same time, the manage-

ment, through the engineering department, undertook such changes in plant and equipment as were needed to improve plant cleanliness. This job of selling never ends, and the work in all three directions must be stressed constantly, for the human element must be dealt with and equipment must be improved and replaced.

To provide a spirit of competition in the good housekeeping campaign, plant No. 3 has been divided into the following 27 departments: Core makers, labor, core fitters, foundry, wire room, brake drum sleeve spin, cylinder cleaning, power plant, carpenters, inspection small parts, garage, brake drum cleaning, cylinder inspection, small parts cleaning, machine shop, welding shop, cupolas, wood patterns, metal patterns, tin shop, millwright, molding machine repair, electrical department, shipping department, yard, laboratory and stores. Plant No. 2 is divided into the following departments: Labor, foundry, cleaning, inspection, cupolas, two core departments, power plant, machine shop, yard, shipping, salvage, pattern shop, stores, garage, electrical department and millwright. These departments are given in the order in which they were rated in the housekeeping campaign during a recent month.

Fig. 3—Daily grade is based on condition of department as compared with other departments

A good housekeeping chart, shown in Fig. 2, is posted in a prominent place in each department on the first of every month. An arbitrary system of rating has been established which starts each department on the same basis with a rating of 80 points. The rating of 80 is con-

Promoted by the C.W.C. Aid Association for the Employee Welfare and Recreation Fund

A 1936 PRODUCT OF C.W.C.
Direct From Their Muskegon Foundries

"GREY IRON CAST"
Minstrel and Vaudeville Show

BIGGER! BETTER! FUNNIER!

Male Chorus of Thirty Voices
Vaudeville Acts of Merit
Directed by Chris Bowman
Music by
"C.W.C." Jimmy Kolkowski and his Boys

Campus Auditorium
Two Nights Feb. 24 and 25, 1936
Show Starts at 8:15 P.M. Tickets 25 Cents
NIGHT SHIFT MATINEE — SATURDAY AFTERNOON
FEBRUARY 29, 1936 — 2:30 O'CLOCK
Get Your Tickets from Your Foreman. No Reserved Seats

DOOR PRIZE EACH SHOW

Figs. 4 (Left) and 5 (Below)—Each year the employes stage a minstrel show with ticket sales limited to employes and families

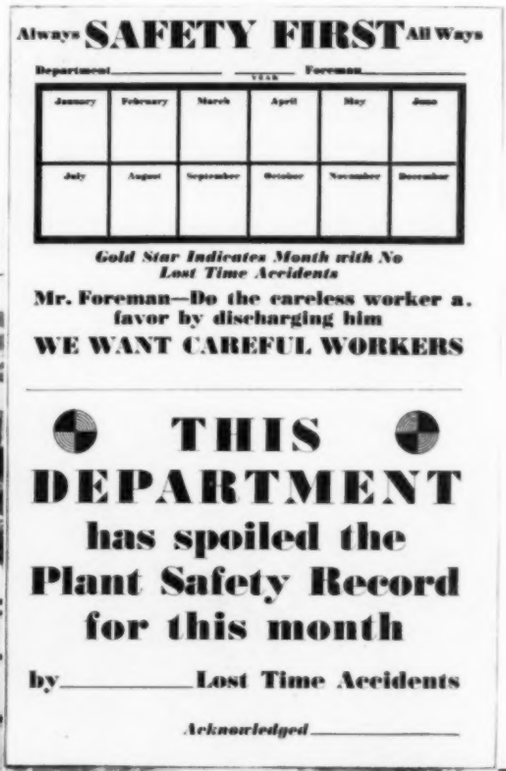
Fig. 6—Plaque awarded to the department ranking first in the monthly housekeeping contest

sidered as just average and the foreman must not go below that figure for the monthly average without answering to the management.

Each department in the two plants is rated daily by one of two safety men. The grade is based upon the condition of each department as compared with the other departments, taking into consideration that certain departments, such as the molding floors, are much more difficult to keep clean than a department such as the power plant. With the foreman responsible for his own department, he usually is present when the inspection has been completed and the grade is marked on the good housekeeping chart. At that time the inspector will explain any penalties which may have been inflicted upon the department and which are reflected in a low grade. The fact that the foreman learns at once of the places in his department where the good housekeeping practices do not meet with requirements permits the correction of the source of trouble immediately after the inspection has been made.

At the end of the month the average grade for each department in both plants is computed. Several incentives have been provided by the C.W.C. management to increase the rivalry among departments for the best good housekeeping record. First, the departments in both plants ranking first, second and third receive cast plaques such as shown in Fig. 6, which remain with that department for the following

Fig. 9 (Right) — Safety first chart is shown above and card which is placed over safety record after an accident is shown below


Always **SAFETY FIRST** All Ways

Department_____ Year _____ Foreman_____

January	February	March	April	May	June
July	**August**	**September**	**October**	**November**	**December**

Gold Star Indicates Month with No Lost Time Accidents

Mr. Foreman—Do the careless worker a. favor by discharging him

WE WANT CAREFUL WORKERS

THIS DEPARTMENT has spoiled the Plant Safety Record for this month

by_____ Lost Time Accidents

*Acknowledged*_____

Fig. 7 (Above)—Crowd in front of the plant just before the gate was opened for the annual family open house. Fig. 8 (Lower Right)—Each foreman made up displays of materials used in department

month. A box of cigars is presented to the foreman or foremen, depending upon the shifts operating, whose department wins first place.

But perhaps the most important feature of the prize program is the large box of candy which is sent by special messenger to the wife of the foreman or foremen winning first place. A special letter from the personnel director of the company accompanies the candy. This letter points out that the husband has won first place in the good housekeeping campaign of the Campbell, Wyant & Cannon Foundry Co. for the previous month. It stresses the fact that the management of C.W.C. believes the foreman *learns his good housekeeping habits at home*, and therefore the company is pleased to send the box of candy in *recognition of the wife's efficient good housekeeping training.*

Creates Interest of Family

Undoubtedly, the box of candy sent to the foreman's wife provides one of the greatest incentives for the good housekeeping program. It has brought out a greater interest on the part of the foreman's family, has provided a greater urge from that source to give more attention to the good housekeeping campaign and has made the foreman well aware that the wife will appreciate his winning just as many times as humanly possible.

The foreman of the department ranking second is presented with a carton of cigarets and a plaque is awarded the department for the following month. The department standing third also secures a plaque, and the foreman is presented with a tin of cigarets. Letters are sent with the awards to the foremen of the three prize winning departments. Second and third place winners are urged to give more attention to the good housekeeping detail with the view of moving up to first place the following month. All of these incentives have been found to aid materially in the good housekeeping program.

Probably the greatest single feature for riveting attention of the foremen upon the housekeeping program is the yellow calcimine carried around by the safety man in a large salt shaker and sprinkled freely where ever dirt has been allowed to accumulate It may be used on tools left lying around, benches not cleaned and materials not in the proper place. In fact, wherever the principles of good housekeeping have not been followed, the yellow calcimine is sure to be found. Every foreman is on his toes to keep his particular department clean, and thus avoid the telltale marks left by a sprinkle of the (*Please turn to page* 65)

Fig. 10—The greater part of the cleanup work is done by workmen in the department at times when they are not busy on regular work

Fig. 11—One safety inspector spends the most of his time talking safety to the men in the plant

Fig. 12—Supervisor's club room provided by the company where the foreman may hold departmental meetings. Fig. 13 (Below)—Good housekeeping aids production of castings

ous scrap exposes a larger area than ingot metal to the flame in the furnace and therefore to a greater extent is exposed to the oxidizing influence. Unless proper precautions are observed the metal may be burned or oxidized, or, the metal, particularly copper, will absorb gas which shows up later as cavities in the castings.

Fortunately the great majority of the castings are classified under three main heads, yellow brass, red metal and steam metal. The first con-

MELTS SCRAP METAL IN BRASS FOUNDRY

Fig 1 (Above)—A long pipe lever suspended from a monorail facilities lifting the pots. Fig. 2 (Below)—The molder skims and pours his own metal

PERHAPS in no branch of the foundry industry is specialized skill and knowledge, particularly in the manipulation of metal, more apparent and necessary than in the ordinary general nonferrous jobbing shop where castings in small and large numbers are ordered in practically limitless sizes and shapes and in almost infinite variety of metal combinations. In certain instances virgin metals must be melted to meet definite specifications in appearance or physical properties of the castings. In these instances a man without extended experience readily can make up any desired combination since only elementary arithmetical calculations are involved. The same is true with the use of ingot metals made up to definite analytical standards. Where all scrap is employed an intimate knowledge of the miscellaneous material, a form of knowledge only to be acquired through long practical experience, is required in making up the charges.

In addition to the problem of selecting the material, the foundryman employing all scrap or a large proportion of scrap, has to modify his melting practice to a certain extent. Light miscellane-

tains approximately copper 70 per cent, zinc 25.5 per cent, tin 2.5 per cent, and lead 2 per cent. Ordinary red metal, also known as eighty five-three fives is made up of copper 85 per cent and 5 per cent each of lead, tin and zinc. Steam metal, also known as admiralty metal, gun metal, and government bronze contains copper 88 per cent, tin 10 per cent and zinc 2 per cent.

Composition of various types of miscellaneous brass and bronze castings may vary to a considerable extent from these standards without affecting the utility of the castings. Close adherence to definite analysis is required only where the color of the finished casting is an important factor, or where the casting is designed for service under exceptionally severe conditions. A familiar example of the first class is a casting which forms part of an assembly made up to a greater or lesser extent of rolled or extruded parts. Manifestly the color of the cast part must harmonize with the color of adjacent parts. The second class includes castings resistant to corrosion, valves and other castings used in connection with gases or liquids at high temperatures or high pressures, aluminum and manganese bronzes for castings in which high tensile strength is the predominating factor. Virgin metal or secondary ingot metal of special composition, coupled with close control and expert melting practice practically are mandatory in the production of castings of the foregoing characteristics.

Selected With Skill and Care

However, in the ordinary jobbing brass foundry a great variety of castings may be made from all or nearly all scrap charges provided the foundryman is thoroughly familiar with metals and selects his materials with care and skill. By keeping a close eye on the markets, and by keeping in close touch with available sources of supply he can keep his bins filled with desirable material and effect economies at the beginning of the production schedule. A shrewd buyer, a man who knows what he wants, and who also knows where, when and how to get what he wants at a

favorable price, is the foundation of each industrial pyramid made up of purchase, production, distribution and sales.

The Keystone Brass Works, Erie, Pa., of which M. Rowley, is president, purchasing agent and general manager, is fairly typical of many plants made up of brass foundry and machine shop. Under normal conditions operations are divided about equally between the production of a standard line of plumber's supplies, and a wide range of miscellaneous castings. Under stress of circumstances activity in either branch may be increased or diminished, with a decrease or increase in the corresponding branch for any given period. This flexibility of arrangement steadies the operating program, a highly desirable feature at any time and particularly during the past few years.

The original foundry building constructed of wood was destroyed by fire several years ago and was immediately replaced by a modern brick, steel and glass structure extending from the street at one end to the machine shop at the other end. Ample light and ventilation are provided by continuous windows in the side walls and in the roof. In winter a long pipe shown at the right in Fig. 2 discharges warm air through a short nozzle in the vicinity of each molding machine.

Castings Made on Two Floors

Odd jobs, large and miscellaneous castings are made by hand on two floors. All other molds are made on a battery of air operated squeezer machines made by the Tabor Mfg. Co., Philadelphia .The machines are set up close to the wall and the molds are placed in straight rows on low skidways extending from a point close to each molding machine to the gangway extending along the opposite side of the shop. One side of the skidway is higher than the other to support the molds in a position where the sprue is at the higher side. This conforms to the practically universal custom in brass foundries where a large number of small castings are made in a single mold. The runner from the sprue carries the metal first to the lower mold cavities and then backs up gradually filling the other molds. In this manner the metal enters the molds gently and fills them uniformly in succession.

Floor space is conserved when necessary by placing a second tier of molds on top of the first. The second tier is slightly offset to expose the sprue on the lower tier. Metal is poured into the lower tier before it is poured into the tier on top. If the upper tier was poured first, drippings from the pot lip, or splashes from the upper sprue might fall into the lower sprue. The work of shifting weights also is minimized by this practice, since the weight on the upper mold is sufficient to hold both upper and lower copes in place. Hence the weight is shifted only once for each pair of molds instead of for each single mold.

Items shown in Fig. 4 are typical of the methods and equipment employed in making the molds. The cope is on the bench at the left, the drag with cores in place in resting on the table of the molding machine, while the pattern plate showing the distribution of the patterns, the gating arrangement and the attached vibrator is resting temporarily on the squeezer head of the machine. Several methods are available for holding cores without chaplets in small elbows and other castings of the same or a somewhat similar character. In some instances the patterns are arranged in pairs and a single one piece core extends through each pair of castings. Gripped firmly at the center and at both ends—three point bearing—it is apparent that the core cannot move.

Cores Are Anchored Differently

In the mold shown in Fig. 4 the cores are anchored in a different manner. Core prints on individual patterns are a little longer than usual and in addition the ends are enlarged by a collar. Prints on the cores are a shade larger than the prints on the pattern and therefore are held rigidly by the sand forming the upper and lower core prints in the mold. While making the mold the molder places a continuous, light steel band inside the snap flask. After the snap flask is removed the band remains in place around the block of sand a precaution which prevents the sand from spreading, straining or bursting open through pressure exerted by the molten metal.

Method of making the cores for these castings, as shown in Fig. 3 is typical of the methods and equipment employed extensively in ferrous and nonferrous foundries (*Please turn to page* 68)

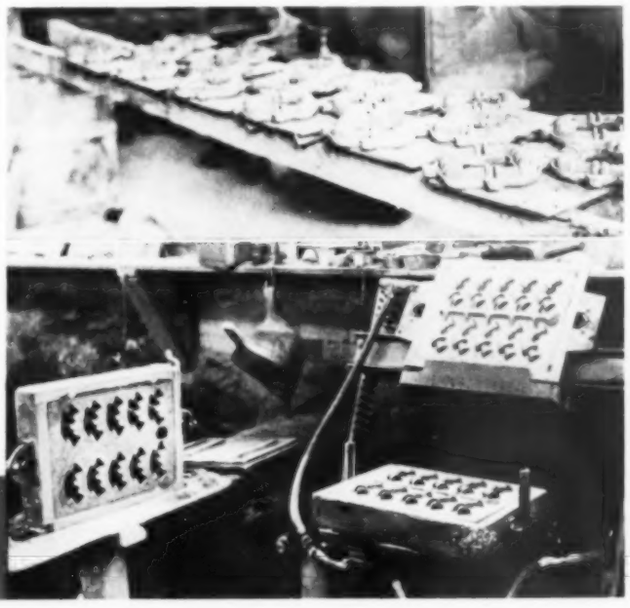
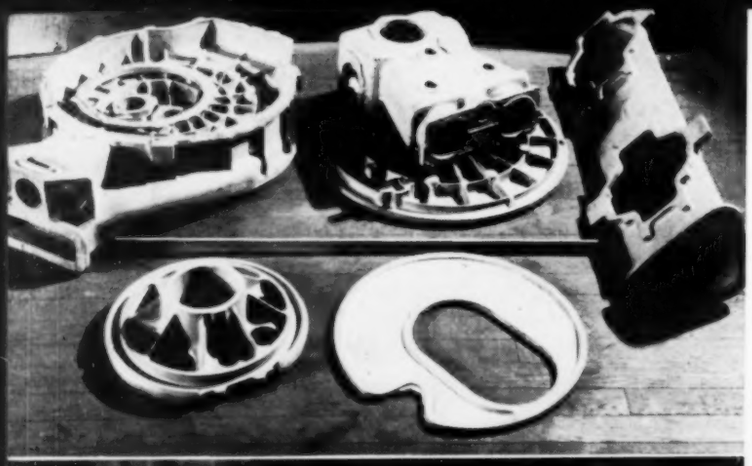
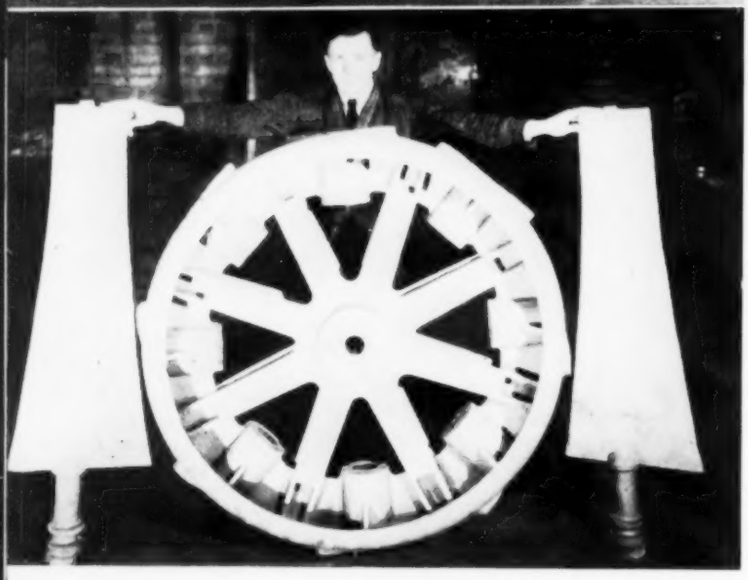


Fig. 3 (Above)—Small cores are made in pairs and cored in metal shells. Fig. 4 (Below)—Special taper prints hold the cores firmly in small elbows





FOUNDING MAGNESIUM ALLOYS

By DR. JOHN A. GANN
and
MANLEY E. BROOKS

Fig. 9 (Above)—Group of aircraft castings—Courtesy Wright Aeronautical Corp. Fig. 10 (Below)—Hub and two blades of 12-foot fan in Radio City cooling tower

THE lowest possible pouring temperature always should be used in casting magnesium as this will insure sounder castings with maximum physical properties and will help reduce melting losses. Temperature control can occur in the pot or in the ladle, depending on whether a single type of casting or a variety of castings requiring different temperatures are being poured. Iron-constantin thermocouples are very satisfactory. These are prepared by welding a constantin wire to the inside tip of a closed thin-walled iron tube.

The casting ladle shown in Fig. 3 (THE FOUNDRY for February) has a parting sweep, retaining shield, and under-feed pouring spout. The sweep is used to part the film of flux covering the surface of the metal in the pot and to permit the dipping of clean metal. Oxide films that form on the surface of the metal in the ladle are held back by the retaining shield. The entrance to the underfeed pouring spout is a short distance from the bottom of the pouring ladle and is provided with a flange, thus retaining in the ladle any small amount of flux that may have been dipped with the metal.

Prior to pouring, the ladle is preheated and cleaned by washing in the flux underneath the metal at the bottom of the pot. After inverting and draining the ladle, it is rinsed two or three times with metal. This is accomplished by parting and skimming back the flux from a small area on the surface of the metal. The edge of the ladle is held slightly below the surface, whereupon clean metal flows into the ladle. Part of this metal is poured through the spout and the balance is poured rapidly out of the back of the ladle. The clean ladle is then filled with metal for casting as previously described in rinsing. If the flux film does not reform automatically as the ladle is lifted from the metal, the exposed surface is protected by sprinkling with powdered flux, or a mixture of anhydrous, flake, magnesium chloride and salt.

Minimize the Surface Oxidation

Surface oxidation of the metal in the ladle is minimized by dusting on a mixture of sulphur and ammonium fluoride salts. Any excess metal in the ladle, above that required for the casting, is poured back into the pot near its circumference. The ladle can be used repeatedly until fouled by adhering magnesium oxide, whereupon it is cleaned in flux.

When pouring a mold, the lip of the ladle is held quite close to the mouth of the sprue and the stream of metal is maintained as steady as possible to minimize turbulence and entrapping of gas. When the casting must be poured hot or when a large sprue is required, the surface of the metal in the sprue may start to burn. Such fires, or those caused by accidents

such as runouts or spills on the foundry floor, are extinguished readily by covering with regular molding sand.

Castings are rough-trimmed to remove sprues, gates, and risers; sandblasted; and given a first inspection prior to heat treatment. Final clean-up generally follows the heat treating operations. Band saws, made from 20-gage spring temper steel with 4 teeth per inch, are operated at a speed of approximately 4000 feet per minute. Power hack saws should have 10 teeth per inch and hand hack saws 14 teeth per inch. Single-cut files are recommended and the type known as *body worker's* files are quite satisfactory for heavy work. Portable electric or pneumatic chippers, rotary files, and grinders are used to good advantage. Medium-hard grinding wheels are recommended. A grain size of approximately 20 is satisfactory for foundry snagging operations while a grain size of 30 to 46 is best for more accurate work.

Restrict Use of Tools

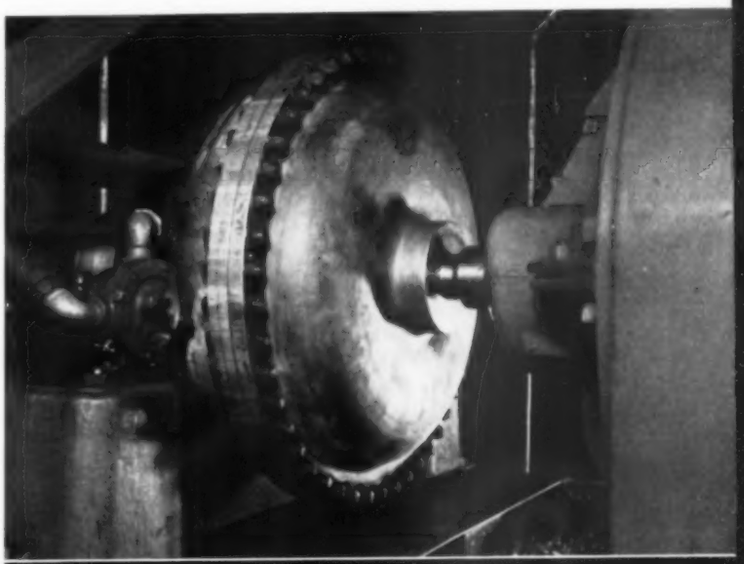
Tools used on magnesium alloys should not be used for other metals to avoid the danger of sparks. This is particularly true with grinders due to the inflammability of the powder. Therefore, special precautions should be taken to see that all skim gates and core wires are removed from the castings before grinding and that the wheels do not touch steel inserts. Operators' clothing should be of smooth cloth with no pockets or cuffs in which dust can collect. The grinding wheels and the floor around them likewise should be kept free from dust, preferably through the use of a suction exhaust system. If proper precautions are observed, the fire risk is small and if ignition should occur the flame will be confined to a minimum of material. Regular molding sand will quickly extinguish any fire that does start. Graphite, table salt, or cast iron borings should be used in case of fire in the machine shop.

One of the outstanding characteristics of magnesium alloys is their remarkable machinability. Machining operations are carried out on standard machines equipped with plain carbon or alloy steel tools, usually the former. Where care is exercised to see that the tools are sharp and have the proper clearance, the machines can be run at maximum capacity. Cuts as heavy as ½-inch with feeds of 20 inches per minute and speeds of 700 feet per minute have been used. Light finishing cuts have been made at speeds of 1400 feet per minute.

Welding and soldering of castings is not common practice in the magnesium foundry as it is with some other metals, although these operations may be used to repair small surface defects in unstressed sections of certain types of castings. In acetylene welding, the casting should be heated to 600 to 750 degrees Fahr. The filler rod should be of the same general composition as the casting, and a flux should be used. The completed welds should be cleaned thoroughly in the chrome-pickle solution and rinsed in water to remove any adhering flux.

Castings to be soldered should be cleaned thoroughly by wire-brushing, chipping, or filing so as to present a clean surface to which the solder can bond. They then are preheated to 300 to 400 degrees Fahr. and the solder vigorously puddled with a sharp-pointed steel tool until it has alloyed with the magnesium. Suitable soldering materials include 90 cadmium—10 zinc or 60 cadmium—30 zinc—10 tin.

Magnesium castings normally are sound and free from pinholes and coarse porosity. Where pressure-tight requirements must be met, as for example in the case of certain pneumatic tool parts, the castings are impregnated with china wood oil. The process consists of a partial evacuation of the container with its charge of oil and castings, followed by the application of pressure to force the oil into any microscopic pores in the surface of the metal. Polymerization, or fixing the oil (*Please turn to page* 84)



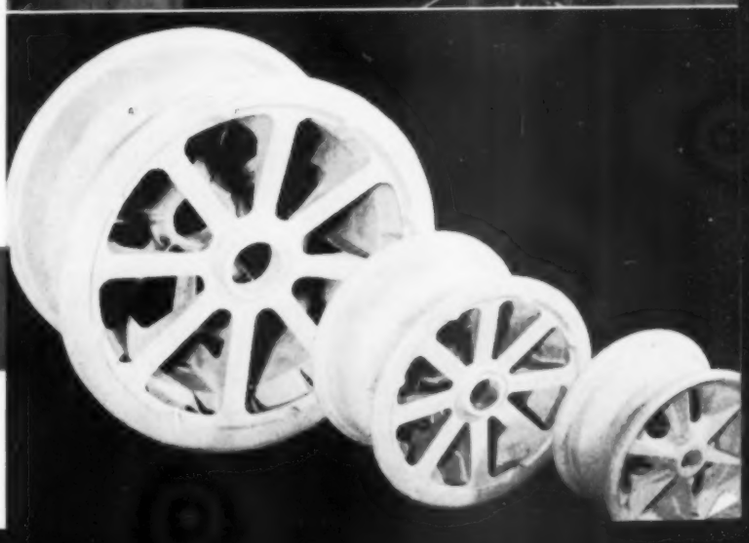
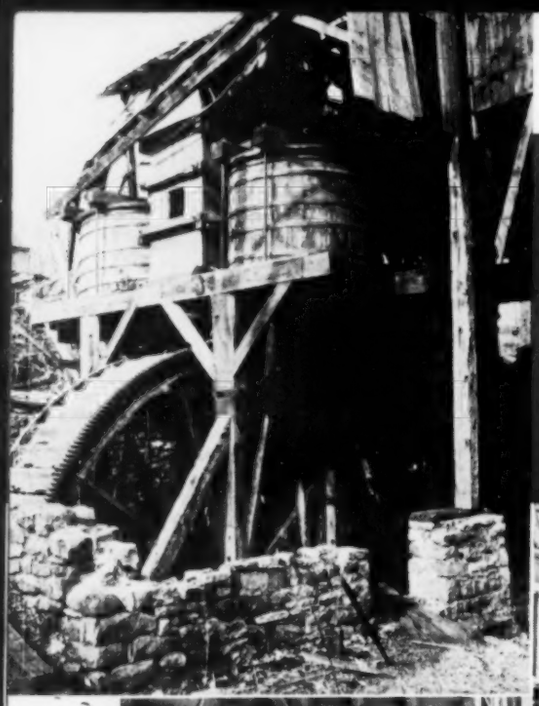


Fig. 11 (Above)—Hydraulic coupling, 43-inch diameter, for variable speed blowers. Fig. 12 (Below)—Aircraft landing wheels, 10 to 36-inch diameter

Steel Castings In Molds Bonded



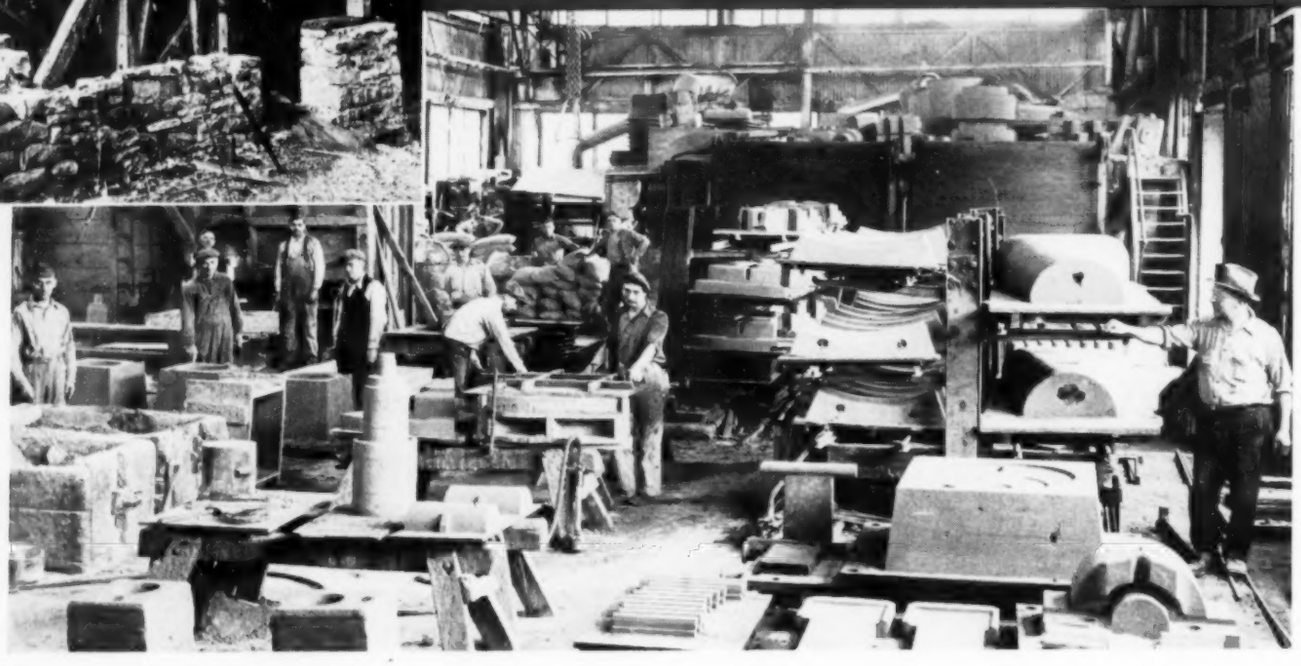


Fig. 1 (Upper Left)—Water wheel and blowing tubs for old blast furnace. Fig. 2—General view of core room showing various types of cement bonded sand cores

IN THE preceding installments of this series of articles dealing with the Randupson process as applied to the construction of molds for steel castings at the plant of the Birsboro Steel Foundry & Machine Co., Birsboro, Pa., the word core was applied to the blocks of cement bonded sand employed in the construction of the various molds. As pointed out previously the use of this term practically is mandatory, since up to the present no term has been coined referring specifically to this particular item. To the foundryman any block of sand formed in a corebox is a core, irrespective of whether it is used to form the inside or the outside of a casting. The question is of academic rather than of practical importance, since practical foundrymen are familiar with the situation. However, for the sake of clarity and for the benefit of readers who may not be intimately familiar with foundry nomenclature, we hope that eventually a proper descriptive term will be coined to differentiate between inside and outside cores.

As shown in the various accompanying illustrations, the Randupson process lends itself readily to the construction of cores, where the term is used in the proper sense, that is a block of sand of any desired shape to form part or all of the interior of a casting. With the exception that the cores are air dried, the routine in the core making department of the foundry, Fig. 2, practically is the same as when the cores were made from any one of the standard sand mixtures. Sand and cement combinations are prepared in a muller type mixer located in the left background. The sand is loaded in wood boxes and distributed by the crane to any desired location on the core room floor. Hand and pneumatic rammers are employed to ram the sand in the boxes mounted on wooden horses. The core plates are heavily ribbed on the back and are machined on the face to present an absolutely flat surface. Since they merely are exposed to atmospheric temperature they retain their shape indefinitely and consequently the cores turned out on these plates also retain their shape.

Taking them as a class it is fairly safe to state that steel foundrymen have devoted more time and attention than any other class of

Are Produced With Cement

By PAT DWYER

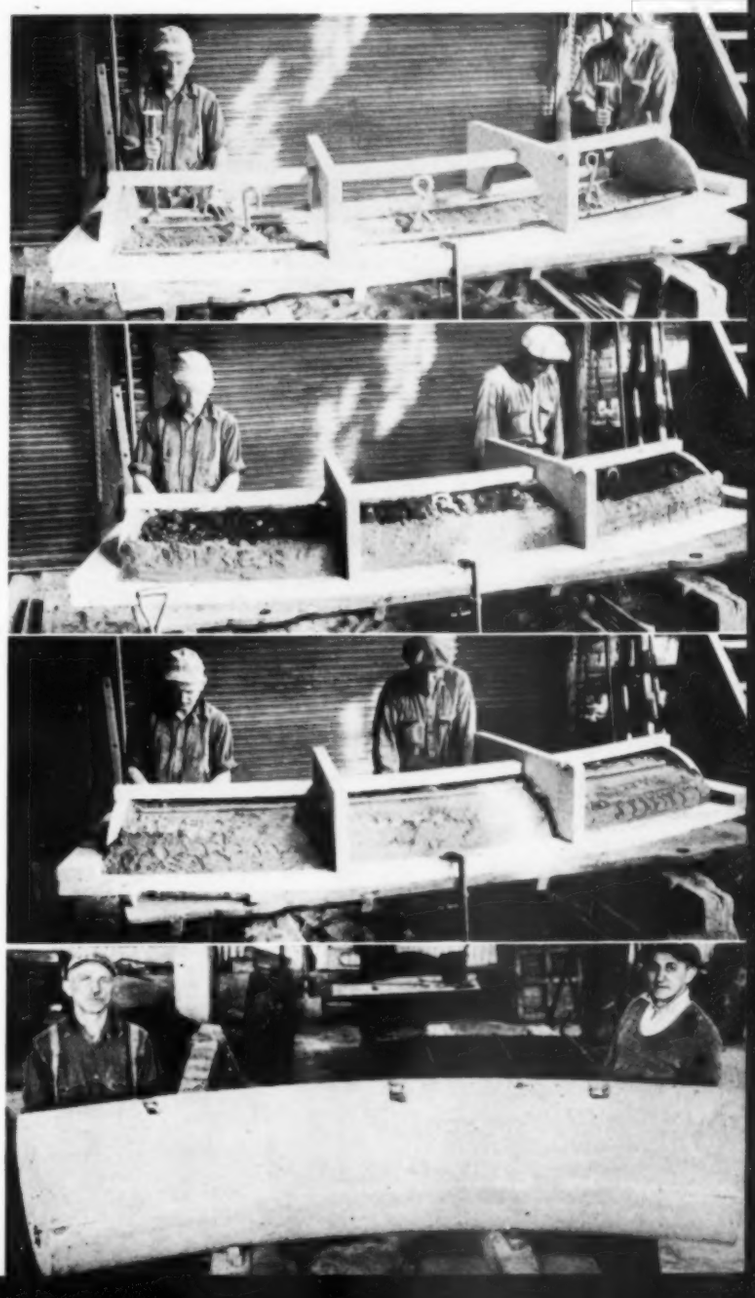
foundrymen to study and development of molding and core sand. The primary reason of course is—with few exceptions and particularly in so far as steel foundries in America are concerned—the sand is a synthetic product. The base is a clear sand of high silica content without any bonding material. This condition does not obtain in the gray iron, malleable iron, brass, bronze and aluminum foundries, where naturally bonded sand is available.

Properly prepared molding sand usually may be depended upon to strip clean from those parts of a steel casting, where the casting shrinks away from the sand face of the mold. The same satisfactory condition is not found where a core or other interior part of a mold is entirely surrounded by metal at high temperature and which grips the sand tightly during the contraction period. The outside and inside surfaces of many typical castings shown in preceding articles in this series, would seem to indicate that cement bonded sand resists temperature and fusing to a rather remarkable extent. This also despite the fact that cores or molds are not surface nailed.

Steps in Producing Core

For purpose of illustration, successive steps in the production of a sand-cement core for a bent pipe 11 feet in length and 22 inches inside diameter, are shown in Figs. 3, 4, 5 and 6. The pattern equipment, a skeleton half corebox is the same as that usually employed in iron and steel foundries for making cores of this character. The core frame is clamped on a flat plate and sand to a thickness of approximately 1-inch is rammed on the inside as shown in Fig. 3 and the necessary rods and hooks for lifting the core are bedded in place. A transverse rod or anchor passes through the lower eye in each hook. A long bent rod on either side rests on the outer ends of the transverse rods. This assembly constitutes a frame on which the weight of the core is distributed when the load is suspended from the three hooks later. The rods and the ends of the corebox then are covered with another thickness of sand, after which cinders are packed in the center from end to end to form a mound that occupies approximately 75 per cent of all the available space. This feature may be noted in Fig. 4. In addition to reducing the cost of core material, the cinders supply the necessary compressible element when the core is subjected to the contraction pressure of the casting.

With the cinders in place, sand to an approximate thickness of 3 inches is banked around the outside and rammed to form a mound conforming roughly to the desired shape of the core. A strickle with two shoulders, one riding



Figs. 3, 4, 5 and 6—Illustrating successive stages in the production of a core for a large pipe bend

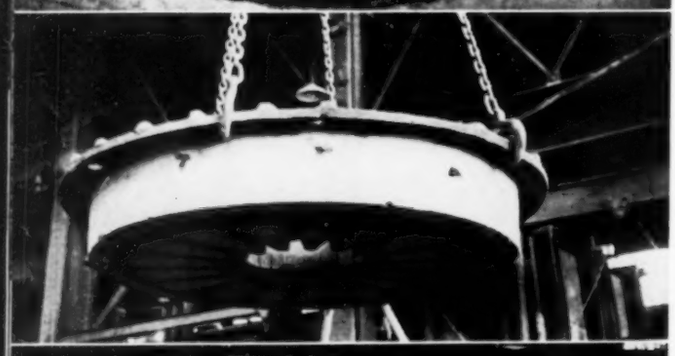


Fig. 7 (Top)—Drag for 72-inch locomotive driving wheel. Fig. 8 (Center)—Cope for the same wheel. Fig. 9 (Below)—Floor of wheel molds in process of assembly

on the top longitudinal member and the other riding on the lower side member, is used to remove the surplus sand and impart the desired contour surface to the core. The frame is removed, placed upon a second plate and the performance repeated for the second half of the core. The coremaker removes the sand immediately surrounding the upper ends ot the lifting hooks to permit insertion later of the hooks suspended from the crane by which the upper half of the core is placed upon the lower half.

After the two halves of the core have become dry and hard enough to handle, the plate and drag half are rolled over and the plate is removed. The upper half is lifted from the plate by the hooks and placed on top of the lower half. The openings over the hooks on top are packed full of sand which hardens into a homogenous mass with the remainder of the sand. No further treatment is necessary. The surface of the core is not nailed or covered with silica wash as in orthodox steel foundry practice. Diametrical contraction on the casting is almost ½-inch, and yet despite these adverse conditions the sand strips clean.

A somewhat different and more intricate type of core is shown in Fig. 11. This core is for a valve casting in a pipe line subjected to unusually severe service. The diaphragm in the center introduces contraction, shrinkage and segregation hazards familiar to all foundrymen. Cores made in cement bonded sand have proved eminently satisfactory. A row of internal chills bedded in the core at the flange areas promote uniform cooling and solidification.

Steel at the Birdsboro plant is melted in three oil fired, acid lined open hearth furnaces, one 30 and two 25 tons capacity. A car load of castings entering one of the 40-foot oil fired annealing furnaces is shown inFig. 10.

Adoption of the Randupson process, a radical departure from formerly standardized methods of making molds for steel castings, is characteristic of the policy of a company and a family of iron masters prominently identified with the iron history of Eastern Penn- (*Please turn to page* 71)

Fig. 10—A wide miscellany of castings as they appear on the car leaving the annealing furnace 40 feet in length

DETROIT CONVENTION PROGRAM TO CHART COURSE OF FOUNDRY PROGRESS

THE technical program, recently announced by the American Foundrymen's association for presentation at the annual convention in Detroit, contains a most valuable collection of papers on a wide variety of foundry subjects. The list of sessions presents a program balanced in the interests of executive, production and metallurgical branches of the foundry industry, with papers dealing with malleable iron, nonferrous, steel and gray iron practice. Other sessions will be devoted to subjects of general interest, such as safety and hygiene, apprentice training, sand control and refractories. Many of the sessions will be held at the Convention hall in Detroit in connection with the 1936 Foundry and Allied Industries exhibit.

The Detroit Chapter of the A.F.A. with Vaughan Reid, City Pattern Works, as chairman, is organizing committees to direct plant visitation, ladies entertainment, golf and certain other program features. The committee is arranging for organized plant visitation on Monday with trips to some of the outstanding industrial plants of the district. While registration, plant visitation and committee meetings will be included on the Monday program, the exhibition will open and the first technical session will be held on Tuesday morning May 5.

A session of special interest to plant executives will feature a symposium on "Progress of Engineering, Medical and Legislative Aspects of Safety and Hygiene in the Foundry Industry." This session is sponsored by the recently formed Safety and Hygiene Section of the A.F.A., of which E. O. Jones is director. Speakers of national prominence will be included on the program.

At the sand research and control session, in addition to reports of the sand research committee, papers on "Practical Foundry Sand Control in Gray Iron Foundries," "Deformation of Molding Sand and Its Relation to Foundry Practice," and the "Effects of Temperature on Molding Sand," will be presented.

The session on foundry refractories is to be one in a series to bring to the attention of foundrymen some of the many problems which are of importance, yet which have been neglected to a considerable extent. Papers will be presented on foundry refractories in general, and on the behavior of refractories in cupolas, and refractories for insulated ladles. The committee in charge of this meeting consists of the chairman, C. E. Bales, Ironton Fire Brick Co., Ironton, O.; A. H. Dierker, Ohio State university, Columbus, O., and John Lowe, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.

The cast iron shop course committee, under the direction of P. T. Bancroft, Moline, Ill., has outlined a series of meetings on the fundamentals of melting practice. Four meetings are to be held—the first on "Cupola Operation and Repair," with Elmer J. Carmody, cupola foreman,

(*Please turn to page* 83)

Tentative Schedule of Technical Sessions

Monday, May 4

Registration — Convention Hall
Plant Visitation

Tuesday, May 5

9:00 a.m.	Exhibits Open — Close at 6:00 p.m.
9:00 a.m.	Cast Iron Shop Course
10:00 a.m.	Formal Opening Meeting
11:00 a.m.	(a) Nonferrous Casting Practice
	(b) Malleable Cast Iron
2:00 p.m.	Sand Research
4:00 p.m.	Sand Control Shop Course (Session 1)
7:00 p.m.	Joint A.F.A., F.E.M.A. and Detroit Chapter of A.F.A. Dinner, Smoker and Entertainment

Wednesday, May 6

9:00 a.m.	Exhibits Open — Close at 6:00 p.m.
9:00 a.m.	Cast Iron Shop Course
10:00 a.m.	(a) Cast Iron
	(b) Malleable Cast Iron Foundry Sand Control
12:30 p.m.	Engineering Instructors Luncheon
4:00 p.m.	Sand Control Shop Course (Session 2)
8:00 p.m.	(a) Apprentice Training
	(b) Foundry Refractories
	(c) Nonferrous Round Table Conference

Thursday, May 7

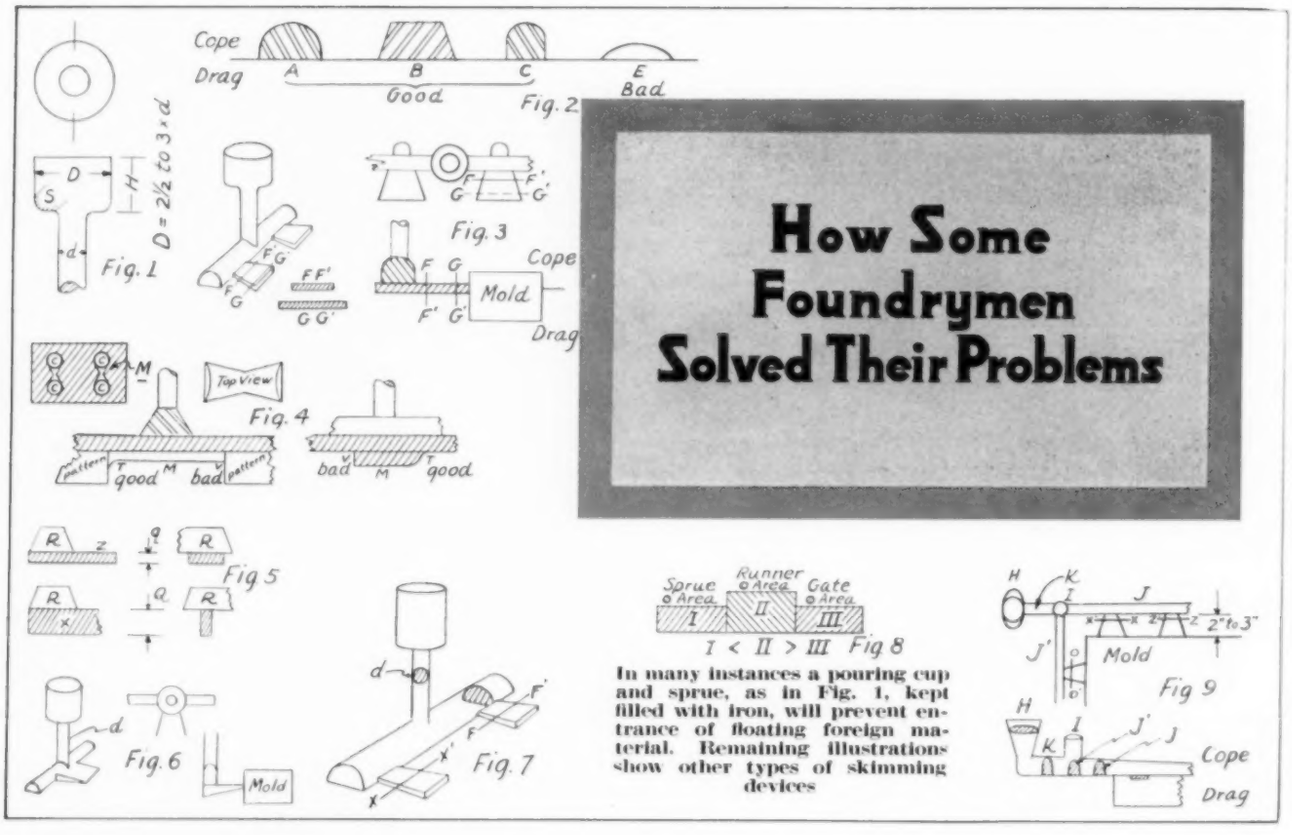
9:00 a.m.	Exhibits Open — Close at 6:00 p.m.
9:00 a.m.	Cast Iron Shop Course
10:00 a.m.	(a) Cast Iron Metallurgy
	(b) Nonferrous Castings
12:30 p.m.	(a) Steel Foundry Round Table Luncheon
	(b) Malleable Round Table Luncheon
4:00 p.m.	(a) Sand Control Shop Course (Session 3)
	(b) Annual Business Meeting
7:00 p.m.	Annual A.F.A. Dinner

Friday, May 8

9:00 a.m.	Exhibits Open — Close at 6:00 p.m.
9:00 a.m.	Cast Iron Shop Course
10:00 a.m.	(a) Steel Founding
	(b) Cast Iron (Alloy Cast Iron Symposium)
2:00 p.m.	Symposium on Progress of Engineering, Medical and Legislative Aspects of Safety and Hygiene in the Foundry Industry
4:00 p.m.	Sand Shop Course (Session 4)

Saturday, May 9

Exhibits — 9:00 a.m. to 4:00 p.m.



In many instances a pouring cup and sprue, as in Fig. 1, kept filled with iron, will prevent entrance of floating foreign material. Remaining illustrations show other types of skimming devices

Properly Constructed Gate Delivers Clean Metal to the Mold

By A. J. Cassista
Textile Machine Works, Reading, Pa.

SLAG and sand found on the surface of defective or dirty castings are lighter than iron, have a much lower density and easily are buoyed up by the molten metal to float on top. None of this dirt is in the iron itself, unless the metal is in a very sluggish state, a state in which it should not be poured into a mold. All this dirt either is washed into the mold with the stream of metal, or washed loose by it. This dirt will be found on the cope face of the casting, or on the under side of cores or pockets where it has been trapped. A proper gate system should eliminate the possibility of sand and slag particles entering the mold. These must be trapped while on the way from the ladle to the casting. The more traps one has, the greater the opportunity to catch the dirt.

It is impossible to skim a ladle clean. Due to oxidation and slag dislodged from the ladle lining there is always dirt on top by the time one is ready to pour and all the skimming effort is wasted. The only thing to do in this case is to provide a pouring basin that will catch the dirt effectively. Many different types of pouring basins have merit. The cup shown in Fig. 1 has all the combined good features of the other types and is much simpler in construction. Just a few circular strokes with the spoon end of the double ender, or in bench work it may be rammed or pressed out. It is an easy target to hit with the molten stream and readily is choked and kept full.

Although the construction of the pouring cup seems simple, great care should be taken to see that it is made properly. The cup diameter should be 2½ to 3 times that of the sprue diameter and the height should be equal to the diameter, with sides straight and shoulders fairly square. The cup diameter ratio may be larger with smaller sprues. It would be advisable also on the larger size sprues until one has mastered the proper pouring technique.

Size of Cup Important

If the cup diameter is too small, it may be impossible to choke the sprue in time to prevent dirt from flowing down the sprue. Also one would have a smaller target to hit. If it is too large, extra metal will be wasted . The same may be said about a shallow cup. It will be difficult to choke without splashing and will be more difficult to keep filled during pouring. The proper technique for pouring with this type of basin is to aim the stream at the side near shoulder *S*, fill the cup with a quick dip, keep the stream at the side with the cup nearly full, and stop pouring when it is filled. The reservoir of molten metal has a chance to free itself from dirt where the sprue is fed from the bottom. By keeping the stream to one side the shoulder *S* absorbs the shock of the falling (*Please turn to page* 78)

GRAY CAST IRON

By JOHN W. BOLTON

Chapter VI (Continued)

Effect of Lead

THE properties of lead are as follows: Atomic weight 207.2; melting point 621 degrees Fahr.; density 11.34; and crystal lattice, face centered cubic.

Lead and cast iron do not alloy. Additions of as much as 1 per cent to molten iron result in retention of less than 0.01 per cent. Due to the considerable difference in density between lead and cast iron there is no mechanical admixture or solution.

In spite of this, lead additions appear to promote carbide retention to a slight degree. There is an appreciable lowering of transverse and impact strengths, brinell hardness and rigidity in some cases.

When molten iron is poured over a low melting point metal, which is not soluble in it, like lead or zinc a lively ebullition is likely. Such violent stirring of the metal somewhat similar in action to the boiling of iron when poured into a damp ladle, is not beneficial. However, if the metal is allowed to become quiet before pouring trouble is not probable.

References

1—Isaac and Tamman—*Zeitschrift* fur Anorganische Chemie—1907.
2—Williams, Sims and Newhall—THE FOUNDRY, page 5, Jan. 1, 1934.
3—Lentze and Piwowarsky—*Dissertation*—Aachen, 1928.
4—Piwowarsky—*Hochwertiger Grauguss*, page 289, 1929.
5—Bading, Scheil and Schulz—*Archiv fur Eisenhuttenwesen*, Vol. 6 pages 69-73, August, 1932.
6—Spencer and Walding—*Transactions*, American Foundrymen's Association, Vol. 4, page 500, 1933.

Effect of Tin

THE properties of tin are as follows: Atomic weight 118.7; melting point 450 degrees Fahr.; density 7.3 and crystal lattice, body centered tetragonal.

Tin may occur in cast iron due to the addition of tin plate scrap and from certain nonferrous alloys. It apparently is not lost in cupola melting.

Tin up to about 8 or 10 per cent can exist in solid solution in pure iron, probably occurring as the compound Fe_2Sn.

Tin additions lower the initial (primary austenite) and final (eutectic) solidification temperatures, but apparently have little effect on the eutectoid (pearlite) transformation temperature.

Small additions apparently affect the transverse and impact strengths adversely.

As shown in Table VIII, from Hurst—*Metallurgy of Cast Iron*—and based on the work of Guillett, tin additions to medium silicon irons produce a very marked hardening effect. The hardness is retained at comparatively elevated temperatures. There is comparatively little change in combined carbon percentage. The hardness evidently is due to the formation of a compound or compounds of iron and tin.

References

1—Goerens and Ellingen—*Revue de Metallurgie*—Vol. 5, May, 1917.
2—Guillett—*Revue de Metallurgie*—May, 1917.
3—Guerthler—*Giesserei Zeitung*—Vol. 8, pages 134-135, 1921.
4—Hamasumi—*Scientific Reports* of Tokohue Imperial University, Vol. 13, pages 133-178, 1924.
5—Williams, Sims, and Newhall—THE FOUNDRY—page 5, Jan. 1, 1924.
6—Spencer and Walding—*Transactions*, American Foundrymen's Association, Vol. 4, pages 501-502.

Effect of Sodium

DISSOLVED sodium apparently is an almost impossible constituent of cupola melted iron, although ladle additions apparently result in some absorptions. No marked effects on mechanical properties have been noted.

Claims have been made that sodium in fused soda ash slags may be in slight amount dissociated therefrom and occur in the metal. If so, such amounts are imperceptible as they are not found on analysis, so far as is known. The author thinks that the powerful fluxing and cleansing action of a highly alkaline and fluid slag readily accounts for benefits attributable to its use.

References

1—Piwowarsky—*Hochwertiger Grauguss*, page 287, 1929.

Effect of Magnesium

MAGNESIUM has the following properties: Atomic weight 24.32; melting point 1202 degrees Fahr.; density 1.74 and crystal lattice, hexagonal.

Dissolved magnesium would not be found in cupola melted irons, although its oxide and silicates are common slag constituents.

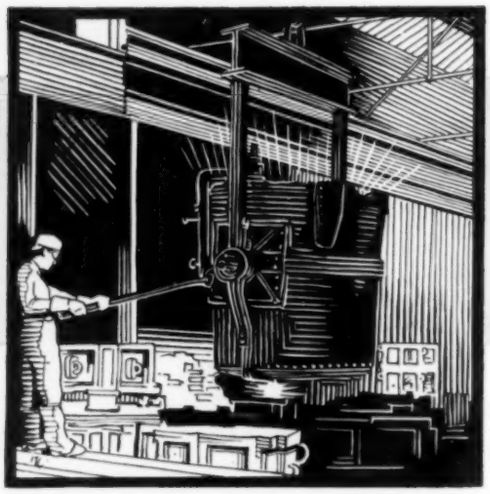
Magnesium has little effect on physical properties. It apparently is a hardener. It is a powerful deoxidizer and has been used widely for that purpose in high nickel alloys—80 per cent nickel and up. However, its utility in gray irons probably is negligible.

References

1—Piwowarsky—*Hochwertiger Grauguss*—page 286, 1929.
2—Moldenke—*Principles of Iron Founding*.

Effect of Titanium

PROPERTIES of titanium are as follows: Atomic weight 48.1; melting point 3272 degrees Fahr.; density (*Please turn to page 74*)



Questions and Answers

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions from subscribers addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the advisory staff.

Alloy Irons Will Meet Requirements for Glass Molds

Can you give us any information on what has been found to be the most successful mixture of iron for molds used by the glass industry?

The manufacture of glass molds is a highly specialized field, and as far as we know there is no one mixture or composition in use. In fact, it might be said that every foundry engaged in that particular field has its own composition for such work. Glass molds must possess a dense structure, have an extremely smooth surface which in some cases can be highly polished, be resistant to heat and scaling, and have minimum growth characteristics.

In general, an alloy cast iron possibly will met those conditions better than any other and it is suggested that you try a mixture which will have the following analysis in the resultant metal: Silicon 1.50 per cent; manganese, 0.60 per cent; total carbon, 3.30 per cent; nickel, 1.50 per cent; and chromium, 0.60 per cent. Another composition that will serve contains 1½ to 2 per cent nickel; 1.60 to 2.00 per cent silicon; and 2.80 to 3.00 per cent total carbon. Another contains 14 per cent nickel; 2 per cent chromium; and 7 per cent copper in addition to the regular amount of silicon and manganese.

Removable Iron Rods Used To Vent Cores for Water Backs

We are having trouble making water backs or jackets for stoves, and would like to know what kind of sand mixture of iron, core sand, and binder to use.

While you do not state what trouble is encountered with the water backs. Presumably it is leakage. That may have several causes, but in general improperly made cores are responsible for a large part of the trouble. The cores must be vented well to carry off the gases generated, and that is accomplished by inserting removable iron rods in the core box during ramming up. No molding sand should be used in the cores, and only sufficient oil binder to insure that they stand up in the green state and have the requisite stiffness after baking. The core sand should be clean and sharp, and it is suggested that you try 45 to 50 parts of sand with 1 part of oil binder. After studying the results obtained, you may be able to reduce the oil.

As far as we know there are no special requirements for the iron and molding sand as the water backs are similar in section to other stove castings. Consequently, if no difficulty is encountered in the other castings from iron and sand, they should be satisfactory. Another point to be watched, is to see that the core is supported at the end opposite the print end so that it does not raise or drop, resulting in nonuniform metal thickness.

Green Sand Will Not Stand Between Vanes of Shell Casting

We are enclosing blueprint of a shell or cover casting 8½ inches diameter and 6 inches deep and reinforced on the outside by 20 thin vanes. We want to rig up for this on a production basis and will appreciate your opinion on the feasibility of making the molds mouth down, that is with the mound of sand for the inside standing on the drag.

We doubt whether you can get green sand to stand up between the vanes, particularly near the center where they come within ⅛-inch of each other. Whatever chance you might have by molding these vanes in the drag, you would

have little or none by molding them in the cope. The job could be done by reinforcing these thin sand bodies with nails, but of course that is out of the question on a production basis. Since the casting is subjected to pressure in service, the iron must fill the mold without creating any disturbance. A green sand core where the casting is molded mouth down is a potential hazard in this respect.

Experience would suggest molding the casting in the opposite position, that is mouth up, with the vanes in the drag, and using a dry sand core for the inside. Even with this method you probably will have to form the bottom face of the mold with a dry sand core, to insure stability of the thin strips of sand between the vanes. This bottom face core can be placed on the pattern so that the vanes coincide with the vanes on the pattern. The drag then is filled with green sand and jolted or squeezed in the usual manner.

Aluminum Castings Are Given Finish by Burnishing

We wish to produce a bright shiny finish on small aluminum castings. How should we go about acquiring that finish? In regard to tumbling, at what speed should the barrel rotate, etc?

Presumably you are desirous of obtaining a bright shiny finish by tumbling or burnishing as it usually is termed, rather than by polishing and buffing. You do not state whether the castings have many re-entrant angles. If they do, it would be difficult to obtain a suitable finish at those points as the burnishing balls do not enter such places well.

Since the castings are small and aluminum alloys are comparatively soft, it is suggested that you use ⅛-inch balls with some 3/16-inch balls, and if there are many corners, that is to say interior corners, it may be necessary to use other burnishing shapes commonly termed slugs, pins, and ball cones. Also the barrel should rotate at low speed to prevent scratching and peining of the casting surface. With a 24 to 30-inch diameter barrel, the speed will range between 12 and 10 revolutions per minute. When charging the barrel usually two volumes of balls are used to one volume of work although you may find a one to one ratio satisfactory. Ordinarily the barrels are filled to within 50 or 60 per cent of the capacity although in the case of very small barrels they are filled completely. The burnishing lubricant usually is water with just sufficient amount to cover work and balls completely.

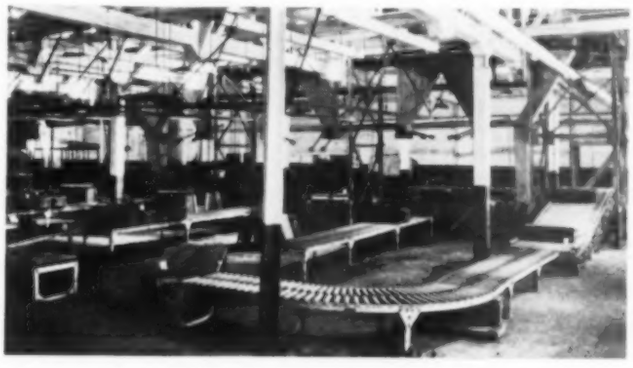
Previous to burnishing, the castings should be dipped in a 3 to 4 per cent caustic soda solution maintained at a temperature of 200 degrees Fahr. After a thorough rinse in clean water the castings are dipped from 10 to 15 seconds in a hydrofluoric acid solution containing 1 part of 50 per cent acid to 9 parts of water. After a thorough rinse, the castings are placed in the barrel and burnished. After burnishing, the castings can be dried by tumbling in dry sawdust. Length of time of burnishing will have to be determined by experiment, since the higher the finish the longer the burnishing.

Alloy Will Increase Heat Resistance of Iron

We make a great many tuyere blocks for stokers but do not seem to obtain the desired life from them as they burn out in a short time. Can you suggest a gray iron mixture that will stand up under the service mentioned?

Since the stoker tuyere blocks from your present mixture burn out rapidly, it is an indication that for the best results, you will have to use a heat resisting composition. Longest life will be obtained from highly alloyed cast iron, and for that reason it is suggested that you employ a mixture containing about 14 per cent nickel, 6 per cent copper, 3 to 5 per cent chromium, and 1 to 2 per cent silicon. However, if you do not desire to use that highly alloyed iron, you undoubtedly can secure a much better life from a lower alloyed iron than from plain gray iron, and a composition in that field will contain about 1.50 per cent nickel, 0.60 per cent chromium, and 1.60 per cent silicon.

The basic mixture for the latter may be composed of 40 per cent pig iron containing 2.75 per cent silicon, 30 per cent steel scrap and 30 per cent gray iron scrap, or it may be made from 40 per cent pig iron containing 2.25 per cent silicon, 20 per cent steel scrap and 40 per cent gray iron scrap. In either case 16 pounds, 5 ounces of nickel and 8 pounds, 9 ounces of 70 per cent ferrochromium will have to be added to each 1000-pound charge. If nickel-chromium bearing pig iron is used instead of ordinary pig iron, the amounts of nickel and ferrochromium added can be reduced accordingly.



Interesting swing gate on conveyor system installed in a radiator shop. Illustration courtesy Mathews Conveyor Co.

Brass Castings Are Not Machinable

We are sending for your examination a small yellow brass flange 3½-inches in diameter and 3/16-inch thick. Our machine shop claims that the metal is so hard that it cannot be machined. The metal is melted in a coke furnace. We are short of space in the foundry so part of the time iron is molded on the brass floor using the same sand for both iron and brass. Any information on the possible cause of the hardness of the castings will be appreciated.

Hardness in yellow brass may be caused by tin or iron, and in your case we believe it is iron. For a definite statement on that point an analysis of the brass would have to be made. Since we have selected iron as the most likely offender, the question will arise as to its source. One source could be the metal itself, particularly if scrap material in any quantity is used. Another source might be from the use of iron skimmers which tend to dissolve in the molten metal when carelessly used. The third possible source lies in your practice of molding both iron and brass on the same floor. That leads to the contamination of the brass by iron in the form of fine shot, etc. which becomes attached to the gates, risers, runners, spills, etc.

The suggested remedy to eliminate the trouble is first to rearrange the brass foundry so that no iron is poured on the brass floor. Then segregate all the scrap gates, runners, risers, etc. resulting from your present practice. If you are sure that your new metal supply at present is free from iron, make new mixtures mainly from that, using only small amounts of the segregated scrap. Keep the new scrap gates, risers, etc. separate from the old since it will be comparatively low in iron and larger amounts can be used with each heat. Continue the practice of using only a small amount of the old scrap until it has been used up.

Sand Blocks Do Not Replace the Usual Dryer

In a recent issue of THE FOUNDRY we noted a reference to sand forms for core dryers. We should like to have further information on the type and ratio of binder used in these sand dryers.

The sand core dryers to which you refer are not used for drying the green cores, but merely for holding some of the 2-part valve cores in correct position while the paste is drying. In this capacity they are exposed to the heat of the oven for only a short period each time and thus may be used repeatedly for months. The form is made by placing a small wood frame around the drag half of one of the patterns on the plate, or around the drag half of a single pattern if the patterns are loose. The frame is packed with core sand, then removed and dried in the oven. The resulting block of sand contains a cavity corresponding to the cavity in the drag of a mold.

Globe valve cores and certain other valve cores are made in two parts in the usual manner and dried in metal forms or dryer shells. The dried drag half of the core is placed in one of the sand core blocks where it sits in prints as later it will sit in the drag of the mold. The second dried half then is pasted in place with one or more prints also resting in a print or prints in the core block. The arrangement merely is to hold both parts in correct relative position while the paste is drying. The core dryer blocks may be made from any regular core sand mixture. In this particular instance they are made from sharp sand 3 parts, bank sand 1 part bonded with oil in the proportion of 1 part oil to 30 parts sand.

Cold Metal Holds Gas Bubbles Under Skin

We are forwarding three small poppet castings which show defects on the machined area. Our mixture is made up of scrap plumbing fixtures to which we add 5 per cent scrap copper and 20 pounds borings to a 250-pound charge melted in an oil fired down draft furnace.

Defects in the castings submitted for examination are caused by steam trapped in the metal. The metal itself and the method of melting apparently are satisfactory with the single exception that the metal has been poured at too low a temperature. However, this is only a minor detail since it merely is reflected as almost invisible cold shut streaks on the skin. Also it is possible that this skin affliction is caused directly by the steam which sharply reduces the temperature of the metal after it enters the mold. The point is directed to your attention because metal at low temperature develops a skin almost instantly in small molds and therefore prevents the escape of any steam or gas that may have entered the metal.

Under ordinary conditions it is probable that your sand and method of ramming are quite satisfactory. However, in this particular instance the steam does not escape readily enough and some of it enters the metal and remains there. An extra volume of steam is generated in the sharp sand corner between the stem and the head of the casting, therefore the obvious method is to provide a ready exit for this steam through the sand. As a preliminary precaution the volume of steam should be reduced by using sand a little dryer than usual and by spacing the patterns a little further apart. It is possible that sand and spacing may be satisfactory, but the sand is rammed a little to hard. Attention to these details, hotter metal, dryer sand, softer ramming and wider spacing of patterns will prevent a repetition of the present defect.

Pipe Connections Cast in Permanent Molds

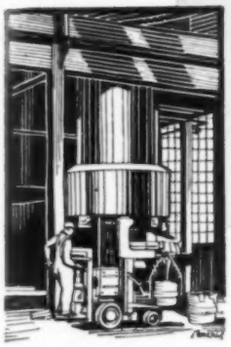
We will appreciate any information you can give me on casting pipe fittings in permanent molds.

So far as the actual production of castings is concerned, several foundrymen have demonstrated that pipe fittings can be produced satisfactorily in permanent molds. However, many other factors are involved in a commercial undertaking. Present method of making pipe fittings in green sand molds has been developed to a comparatively high state of perfection. Up to the present—so far as we know—no prominent foundry engaged in the production of these castings, has switched from green sand to permanent molds.

This is not to be construed as a convincing argument since manufacturers, including foundrymen, of any commodity naturally are conservative and hesitate to scrap existing equipment in favor of something new particularly where the new equipment has not been taken up by others to present active competition.

Descriptive articles covering materials, construction and methods of operation have been presented on many occasions in the pages of THE FOUNDRY, the most recent on page 67 of the August, 1934, issue.

Designers of permanent molds are divided in opinion on the best form of construction to maintain the molds at proper working temperature. A certain number claim that the mold should be sufficiently massive to absorb the heat and dissipate it. Others claim that the walls should be comparatively thin and that proper working temperature should be secured by proper circulation of air, oil or water. In all cases the mold is split vertically instead of horizontally. In some instances the molds is hinged, while in others, one half remains stationary while the second half is moved into and out of position by a mechanical device operated either by hand or by compressed air.



Viewing Foundry Developments . . . AT SHORT RANGE

AFTER extensive experiments, an automobile manufacturer has discovered that the most satisfactory method of producing alloy steel pistons is to cast them in a horizontal position and entirely in green sand. Apparently defying the laws of gravity and liquid pressure the green sand core attached to the drag part of the mold does not move. The pistons are cast eight in a mold and held to a tolerance of three thousandths of an inch in thickness.

• • •

A solution of copper sulphate to which a few drops of sulphuric acid is added, frequently is used for painting over a sheet of zinc or metal pattern to obtain distinct lines when laying out.

• • •

In melting gray cast iron in the electric furnace, one experimenter reports the introduction of a mixture of barium oxide and barium carbonate into the melt in the ratio of about 1 pound per ton of metal immediately preceding the superheating temperature. The thin surface glaze, in the apparent form of barium silicate, which is formed on the lining face, is said to stabilize the silica present and to aid in reducing metal penetration.

• • •

ONE way to cure blistering trouble with enamel on cast iron is to anneal the castings before they are enameled. This operation breaks down the combined carbon and causes the evolution of gases before the enamel is applied. Following the anneal, the castings are sandblasted to remove scale and are enameled in the usual way. Another remedy is to remove the microchill from the castings by grinding or deep sandblasting.

• • •

In certain section of the country where the cold is intense in the winter, molds occasionally are frozen when they are left on the floor over night. Confronted with this experience for the first time, a foundryman may have doubts of the advisability of filling the mold with molten metal. He need not hesitate. Experience has shown that if the mold is in proper condition for the reception of metal, before it is frozen, it will receive the metal in an equally satisfactory manner after it is frozen.

• • •

A manufacturer of cast brake drums uses a metal containing 0.15 to 0.25 per cent chromium and 0.07 to 0.15 per cent nickel. The casting has a brinell hardness of 187 to 228 and is said to provide an excellent braking service.

• • •

IN A recent discussion on the tendency in some instances for core sand to stick to new aluminum coreboxes, the theory was advanced that this may be due to a slightly oxidized condition in the metal at the time of pouring. The oxidation is not sufficient to produce actually visible pin holes, but is sufficient to influence the grain structure to the extent that a perfectly smooth surface is impossible to obtain.

• • •

One manufacturer uses the following approximate annealing cycle for malleable iron and pearlitic malleable iron; 36 hours to soaking temperature—1600 degrees Fahr.; 40 hours at 1600 degrees Fahr.; 14 hours to 1500 degrees Fahr.; 14 hours to 1400 degrees Fahr.; 22 hours to 1300 degrees Fahr.; and 14 hours to 1220 degrees Fahr.

• • •

In making castings from 4 to 7 per cent chromium steel, foundrymen sometimes are confronted with the problem of removing gates and risers by oxy-acetylene cutting. To prevent air-hardening and subsequent cracking, the usual procedure is to preheat the entire casting to a black heat, about 900 degrees Fahr., at which temperature the steel is quite ductile. If the temperature of preheat becomes too high the entire casting may air-harden. In other instances the risers sometimes are cut from dead annealed castings. This may develop hard spots in the vicinity of cutting and the castings must be re-annealed to insure uniform softness.

• • •

SEVERAL foundrymen have found it advantageous to cast bronze gear blanks and other castings in metal molds. In some instances wheels with teeth are cast by inserting suitable dry sand cores inside the metal mold. The mold is made up of a bottom plate, a top plate and an intermediate ring the same height as the face of the anticipated casting. On small wheels, the ring and bottom plate form one casting. Where the ring is separate, it is located on the bottom plate through pins and pin holes. Various size wheels may be made on the same bottom and top plates by changing the rings. The metal is poured through a sprue located close to the side of a center core which projects above the cope. A small gate from the sprue enters a second and larger sprue in the center of the core. This large sprue which also serves later as a feeder, is connected at the bottom to two or more horizontal gates which deliver the metal quietly over the bottom plate. The molds are heated to a temperature of approximately 300 degrees Fahr., before the first casting is poured. Thereafter the temperature is maintained by pouring successive castings as rapidly as the solidified castings are removed. The entire assembly is mounted on swivels for easy manipulation.

• • •

On the assumption that skimming, stirring or disturbance of any kind, oxidizes aluminum and produces pin holes in the metal, a prominent pattern manufacturer pours the metal directly from the melting pot into the mold. He has a battery of melting pots fired with oil and ranging in capacity from 50 to 500 pounds.

Warden F. Wilson

Leslie G. Korte

Robert S. Hammond

Men of Industry

LESLIE G. KORTE recently has been made foundry engineer of Atlas Foundry Co., Detroit. Mr. Korte was born in Detroit on March 15, 1901, and received his early education in the public and parochial schools of Detroit, and technical training at the Detroit institute and the University of Detroit. He started work at the Riley Stoker Corp. plant at Detroit following graduation and progressed through the organization, holding various positions including tool room foreman, machine shop superintendent, chief inspector, and finally general superintendent. He held the latter position for 10 years, resigning on Feb. 1 to become connected with the Atlas Foundry Co.

Mr. Korte is vice chairman of the Detroit Chapter of the American Foundrymen's association and has been a member of the Detroit Foundrymen's association, predecessor of the Detroit chapter, for the past 10 years.

♦ ♦ ♦

ROBERT S. HAMMOND recently was made president of the Foundry Equipment Manufacturer's association. Graduating in 1911 from the University of Michigan, Ann Arbor, Mich., he immediately started in at the Granite City, Ill., plant of American Steel Foundries, working through various departments, including cleaning, molding, engineering, and open-hearth furnace. Later he transferred to the sales department at Chicago, where he became sales agent.

Mr. Hammond left American Steel Foundries in 1919 to become Pittsburgh district manager for Whiting Corp., and in 1921 became Chicago manager. In 1930 he was transferred to the general offices in Harvey, Ill., as sales manager and vice president.

♦ ♦ ♦

WARDEN F. WILSON has been appointed manager of the Pittsburgh plant, American Steel Foundries. Mr. Wilson has been connected with the American Steel Foundries since his graduation from Illinois university and has been assistant manager of the East Chicago, Ind., plant of that firm since April, 1929.

L. R. MEYER has been appointed superintendent of the Pittsburgh plant.

W. J. MILLER, former manager of the Pittsburgh plant, and W. O. Parham, assistant manager, have resigned.

♦ ♦ ♦

G. N. VAN SWERINGEN, recently assistant to the president, Chicago Railway Equipment Co., Chicago, has been made vice president in charge of sales. R. D. BARTLETT succeeds him as assistant to the president. Other officers include President, A. C. MOORE; vice president, W. S. OPPENHEIM; vice president, J. A. EMERY; treasurer and secretary, E. T. WALKER; assistant treasurer and secretary, E. T. WALKER JR.; controller, W. A. FORWARD. E. E. GRIEST, recently vice president, has resigned.

♦ ♦ ♦

RALPH R. TEETOR, in charge of engineering, Perfect Circle Co., Hagerstown, Ind., was elected president, and DAVID BEECROFT, manager of the New York office of Bendix Aviation Co., was re-elected treasurer of the Society of Automotive Engineers at its annual meeting in Detroit Jan. 13-17.

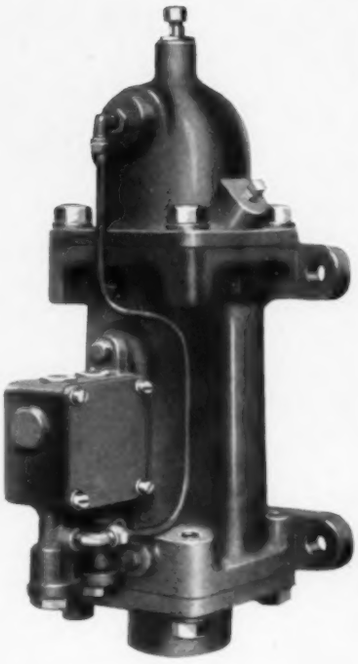
♦ ♦ ♦

LLOYD JONES, vice president of Continental Roll & Steel Foundry Co., East Chicago, Ind., who has been in ill health for the past few months, has resigned. He will remain with the company in a consulting engineering capacity. Mr. Jones was formerly with United Engineering & Foundry Co., and before making his present connection, he was with the E. W. Bliss Co., Salem, O.

♦ ♦ ♦

FRANKLIN FARREL JR. recently was re-elected chairman of the board of directors, Farrel-Birmingham Co. Inc., Ansonia, Conn. Other officers were re-elected as follows: President, NELSON W. PICKERING; vice president, CARL HITCHCOCK; vice president, FRANKLIN R. HOADLEY; vice president, ARMIN G. KESSLER; treasurer, FREDERICK M.

(*Continued on page* 42)



JOLT TIMER

Consists of a Timing Plunger controlled by two simple valves.

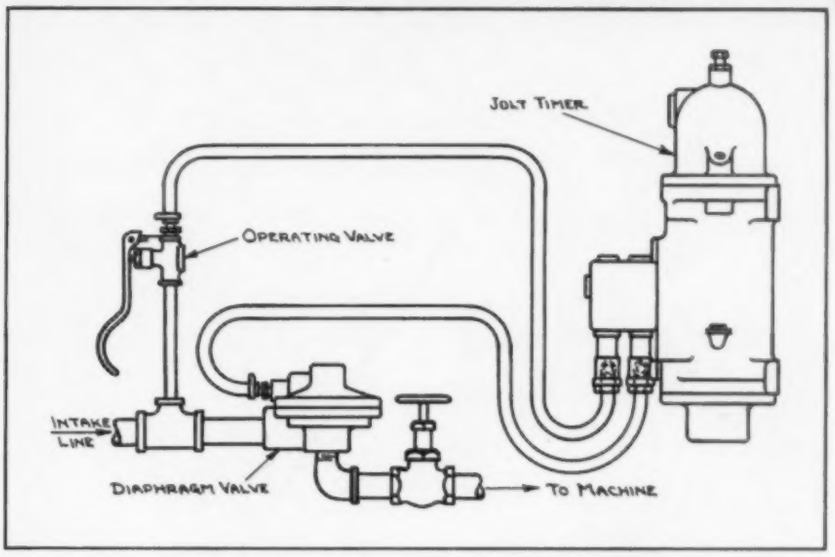
DIAPHRAGM VALVE

This Valve is controlled by the Timer. Diaphragm Valve replaces hand valve.

OPERATING VALVE

When operator presses Operating Valve Lever, the Timing Mechanism goes into action relieving attention of operator during jolting operation.

NEW PNEUMATIC



JOLT TIMER

Controls Ramming of Moulds to Same Degree of Hardness

- Controls number of jolt blows accurately and releases operator for other duties.
- Attaches easily to any type and size of jolt moulding machine. Same Timer may be used for any capacity of air line. However, Diaphragm Valve must be of proper size to suit air intake line to machine.
- Operates entirely by air which eliminates use of special oils or installation of electric supply lines.
- Advantages of three separate units of equipment are that Diaphragm Valve may be mounted at any practical point in air line and Operating Valve in most convenient position for the operator.
- Assures dependable operation with a minimum of maintenance.

For complete information, write

THE OSBORN MANUFACTURING COMPANY

5401 HAMILTON AVE., CLEVELAND, OHIO, U. S. A.

Agencies strategically located all over the world

OSBORN

(*Continued from page 40*)

DREW JR.; assistant treasurer, LAURIE K. BLACKMAN; secretary, GEORGE C. BRYANT; and assistant secretary, WILLIAM B. MARVIN.

♦ ♦ ♦

E. E. GRIEST recently was made vice president and general manager, Fort Pitt Malleable Iron Co., Pittsburgh. Mr. Griest was born in Zanesville, O., in 1882. He served as a machinist apprentice, machinist and foreman of the Pennsylvania shops, Columbus, O., from 1900-1904, and then entered Purdue university, Lafayette, Ind., graduating in the class of 1907 with a Bachelor of Science degree in mechanical engineering. After graduating, he was employed for a short time in the engineering department, Park Works, Crucible Steel Co. of America, Pittsburgh. He then was machine shop foreman, Erie railroad, Hornell, N. Y.

From 1908 to 1918 he served as assistant general foreman, assistant master mechanic and master mechanic of the Pennsylvania railroad shops, Fort Wayne, Ind. He joined the Chicago Railway Equipment Co., Chicago, in 1918 as assistant general superintendent and in 1919 was made general superintendent. In 1931 he was elected vice president in charge of manufacture and served in that capacity until his resignation on Feb. 15, 1936.

Mr. Griest is a member of the American Foundrymen's association, American Society of Mechanical Engineers, Western Society of Engineers, American Society for Testing Materials, Western Railway club. He is president of the Malleable Iron Research institute and director and chairman Western Section Malleable Founders society. During the NRA he was a member of the code authority of the malleable industry and the concrete reinforcing industry, and active as a member of the rail steel bar industry. He is the author of numerous articles presented in the technical press and papers delivered before technical societies.

♦ ♦ ♦

LESTER B. KNIGHT, JR., vice president in charge of sales, National Engineering Co., Chicago, is the author of the annual exchange paper of the American Foundrymen's association to be presented at the 1936 convention of the Association Technique de Fonderie, the foundry technical association of France. The convention will be held in Lille, France, in June. The exchange paper will deal with the more recent developments in sand conditioning and handling.

Mr. Knight was graduated from Cornell university, Ithaca, N. Y. in 1929 with a degree in mechanical engineering. He first became interested in sand control while at the university through his work with Dr. H. Ries, who, as director of the A.F.A. committee on sand research, was conducting an investigation at that time. During summer vacations Mr. Knight worked in the foundry of Abendroth Bros., Port Chester, N. Y. and in the sand testing laboratory of Bethlehem Steel Corp.

Following graduation, he became a sales engineer with the Illinois Clay Products Co., Joliet, Ill., and several years later accepted a position with the National Engineering Co.

♦ ♦ ♦

NEIL CURRIE JR. has been made manager of the Fort Wayne, Ind., works of General Electric Co., Schenectady, N. Y. He has been manager for the past six years of the Philadelphia works, and at Ft. Wayne succeeds WALTER S. GOLL, who is retiring as manager but will continue with the company.

R. V. GOOD, previously assistant manager at Philadelphia, was appointed manager to succeed Mr. Currie.

♦ ♦ ♦

EARL TURNER, Cleveland, recently has become associated with the organization of Arthur J. Tuscany, Penton building, Cleveland, which supplies secretarial service and executive direction to trade associations and other groups.

Mr. Turner has had considerable experience in the trade association field. For many years he was manager of the Automotive Electric association, and in that capacity, directed the organization's activities including several trade association services, the development of sales and merchandising efforts designed to assist the manufacturer, jobber and service station. He is a member of the board of directors of the American Trade Association Executives, member of the American Management association, the American Academy of Political and Social Science, and an associate member of the Society of Automotive Engineers.

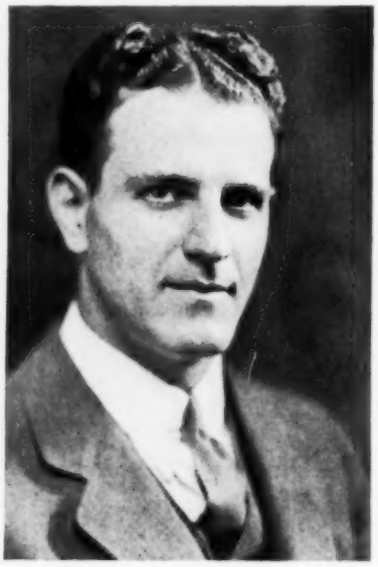
In the foundry field, Mr. Tuscany's organization now is providing executive direction and secretarial service for the Foundry Equipment Manufacturers' association.

♦ ♦ ♦

HARRY B. CLAPP has been appointed transportation engineer of the Clark Tructractor Co., Battle Creek, Mich. Mr. Clapp is a native of Michigan and an engineering graduate of the Colorado School of Mines. He will make

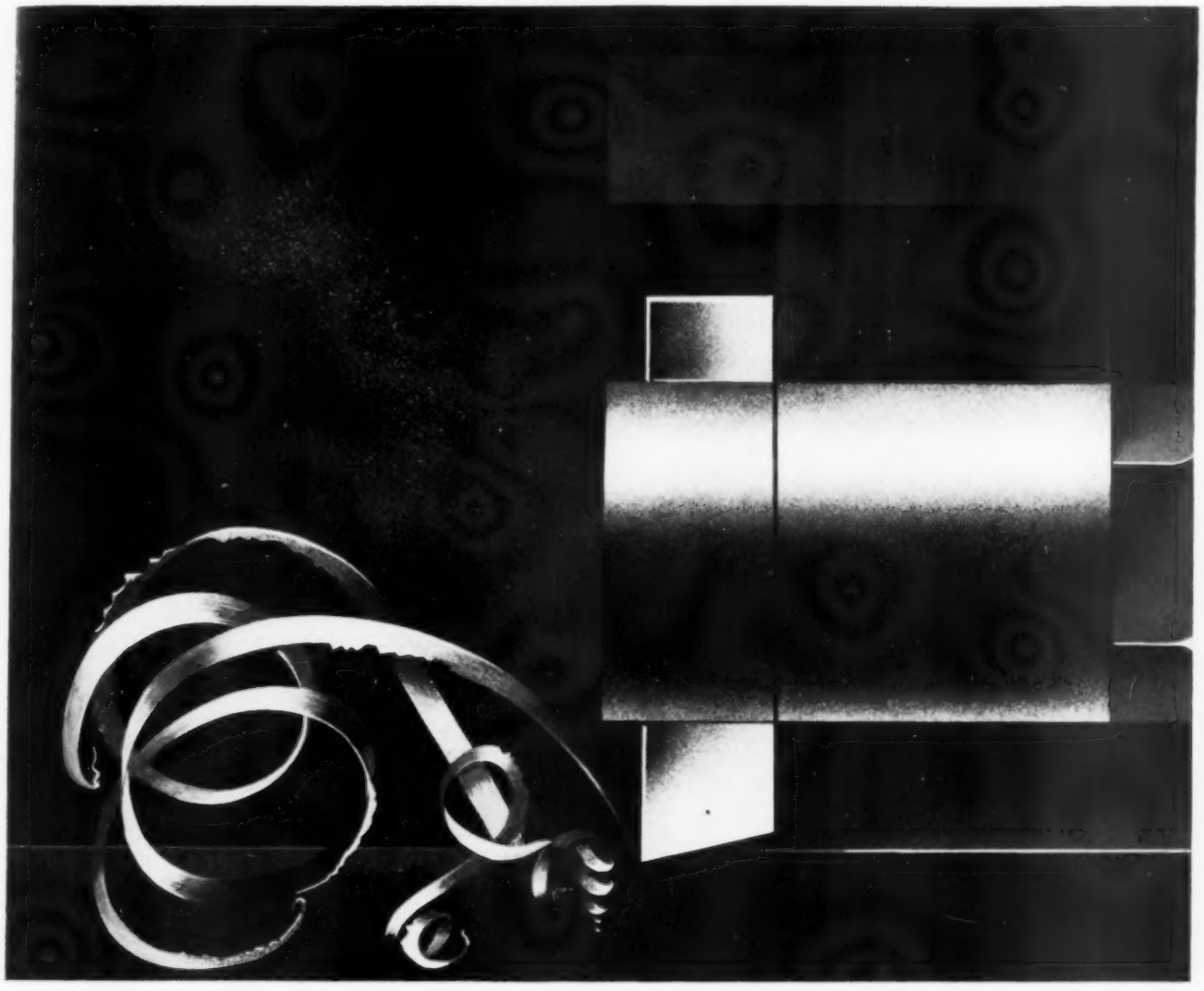
(*Continued on page 44*)

E. E. Griest



Lester B. Knight Jr.

Earl Turner



MOLY pares machining costs

MACHINE SHOP cost sheets often contain an accumulation of items that are avoidable. Some are caused by hold-overs from other processes — rolled-in scale — non-uniform hardness — distorted parts — meaning excessive tool, labor and material costs.

They are avoidable by standardizing on Molybdenum steels. Forgings are less likely to be scaly, seamed, or temper brittle. Carburized parts are less apt to be inconsistently distorted. High cutting speeds are safer and close tolerances more easily maintained. Time, power, labor, tool and material costs can be greatly reduced.

One maker of tool joints for oil-well service — a high-volume precision job — reports a 10% saving in over-all machine costs by standardizing on Chrome Moly steel (SAE 4140).

Your particular case may not be exactly similar, but — the savings in production costs effected by Moly steels and irons are not confined to the machine shop. So, it will pay you to investigate Moly in connection with your own problems. Our laboratory facilities are available if you are interested. Meantime our helpful technical book, "Molybdenum," is yours for the asking — as is also our periodically published news-sheet, "The Moly Matrix." Climax Molybdenum Company, 500 Fifth Avenue, New York.

CUTS COSTS CLIMAX Mo-lyb-den-um CREATES SALES

(*Continued from page* 42)

his headquarters at Battle Creek as special engineering assistant to EZRA W. CLARK, vice president.

♦ ♦ ♦

LEON B. THOMAS, formerly assistant technical superintendent, Ohio Brass Co., Mansfield, O., recently was made chief chemist and metallurgist, Campbell, Wyant and Cannon Foundry Co., Muskegon, Mich.

Mr. Thomas received his education at Mt. Pleasant Academy, and Carnegie Institute of Technology, being graduated from the latter in 1914. Following graduation he undertook a two years' apprentice course with the Westinghouse Electric & Mfg. Co., and then entered the research laboratories of that firm where he was connected with the manufacture of amunition during the war.

Leon B. Thomas

Four years after the close of the war he became chief chemist and metallurgist of the Fairbanks, Morse Co., Three Rivers, Mich., and later was made foundry superintendent of that company, being connected with that firm for 6 years. He then was appointed assistant technical superintendent of the Ohio Brass Co.

At Campbell, Wyant & Cannon Foundry Co. he has complete supervision of all laboratories at Plant No. 1 and 3.

♦ ♦ ♦

J. E. HURST, president, Institute of British Foundrymen, has been chosen by that organization as the author of its annual exchange paper to the annual convention of the A. F. A. The paper will cover "The Heat Treatment of Cast Iron by Hardening and Tempering."

Mr. Hurst is a leading British authority on centrifugal casting and heat treatment of cast iron. He has been active in the development of cast iron metallurgy, particularly in connection with the centrifugal casting process. His researches in the heat treatment of cast iron of both the plain and especially the alloy types, have brought about important developments in the progress of the cast iron industry, particularly in the field of nitrogen hardening. He is technical director, Bradley & Foster, Ltd., Darlaston, and also of Sheepbridge-Stokes Centrifugal Castings Co., Ltd., Chesterfield, England.

J. E. Hurst

Mr. Hurst was at one time assistant chemist at the locomotive works, Beyer Peacock & Co., Ltd., Gordon, Manchester, and later became chief chemist and metallurgist, Richard Hornsby & Sons., Ltd., Grantham and Stockport. During the war, he was chief chemist and metallurgist, D. Napier & Sons, Ltd., Acton, London.

He has taken an active and prominent part in the Institute of British Foundrymen for many years and has presented numerous papers before the various branches of the institute. In 1932 he was awarded the Oliver Stubbs Gold Medal for his extensive contributions to the metallurgy of cast iron. He also is a member of the Iron & Steel institute, of which he is a Carnegie Research Scholar, of the council of the British Cast Iron Research association, the Staffordshire Iron & Steel institute, and Verein Deutscher Giessereifachleute. He is the author of several text books, including *Melting Iron in the Cupola* and *Metallurgy of Cast Iron.*

♦ ♦ ♦

DAVID R. WILSON recently was appointed trustee to operate the Willys Overland Inc., Toledo, under Section 77B of the Federal Bankruptcy Act. The appointment was made by Judge Hahn who dissolved the receivership.

♦ ♦ ♦

R. G. MCELWEE recently has become connected with the Vanadium Corp. of America with headquarters in the Book building, Detroit.

Mr. McElwee was born in Williamsport, Pa., and in 1915 entered the employ of the Muncie Foundry & Machine Co., Muncie, Ind., as chief inspector. A year later he became connected with the General Motors Truck Co., Pontiac, Mich., as buyer, and in 1927 was made engineer of the American Car & Foundry Co., Detroit. From 1928 to 1932 Mr. McElwee was employed as foundry engineer with Whitehead & Kales Co., River Rouge, Mich., and in the latter year became connected with the Ecorse Foundry Co., Ecorse, Mich.

R. G. McElwee

In his new connection, Mr. McElwee will confine his activities to consulting work on the use of alloys manufactured by the Vanadium Corp. in gray iron and malleable iron foundry work. He also will be engaged in the correlating of research work to practical applications.

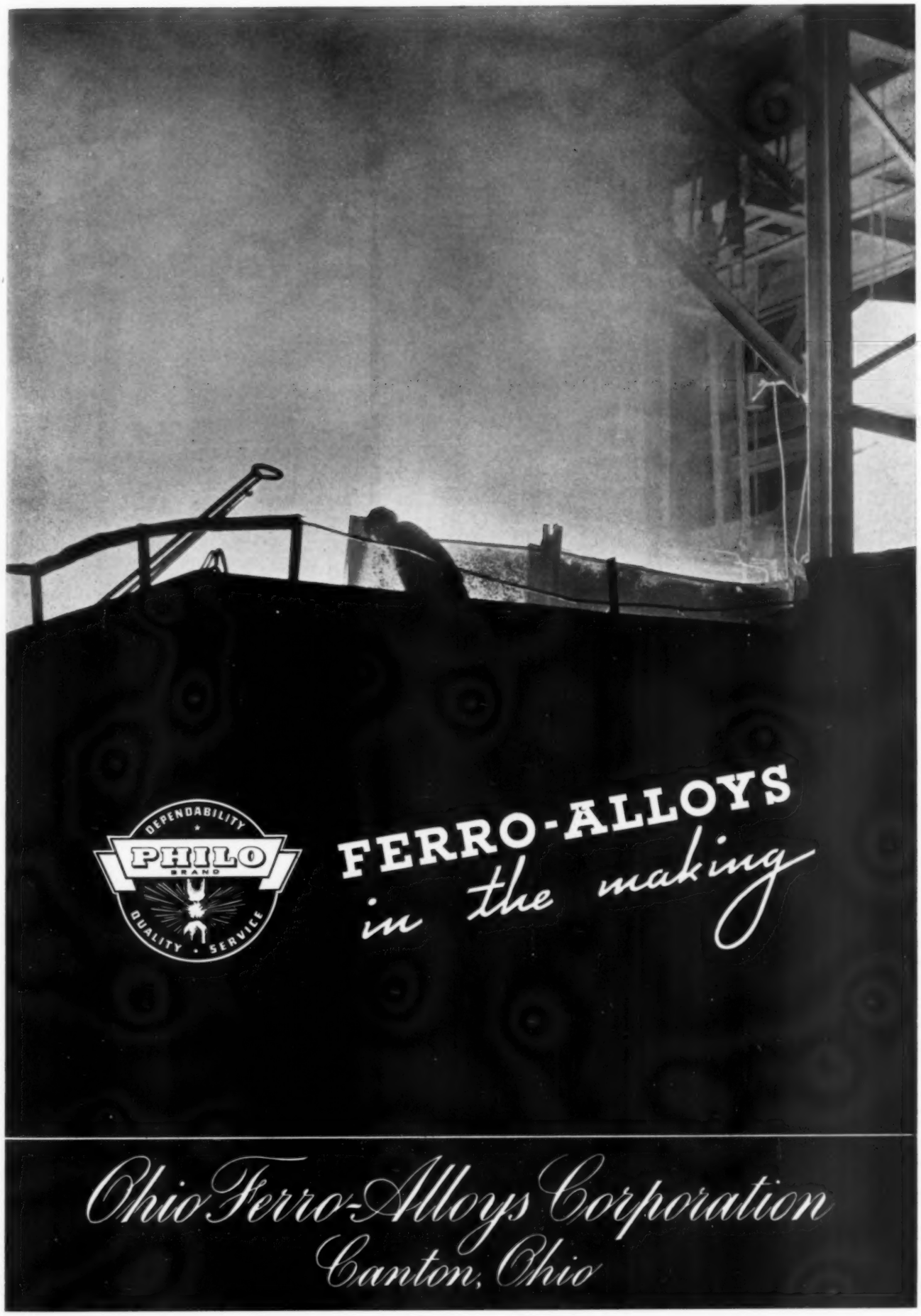
♦ ♦ ♦

B. R. PARKER, formerly pattern foreman, Ohio Brass Co., Mansfield, O., has joined The Di-Mold Casting Co., Dayton, O., as pattern foreman.

♦ ♦ ♦

GEORGE P. HALLIWELL, formerly assistant professor of metallurgy, Carnegie Institute of Technology, Pittsburgh, has been appointed director

(*Concluded on page* 46)


DEPENDABILITY
PHILO
BRAND
QUALITY • SERVICE
FERRO-ALLOYS
in the making
Ohio Ferro-Alloys Corporation
Canton, Ohio

(*Concluded from page* 44)

of research, H. Kramer & Co., Chicago, refiners of nonferrous metal scrap and producers of brass ingots and nonferrous alloys.

♦ ♦ ♦

LOUIS J. DESPAROIS has been made district sales manager of the recently opened St. Louis office of Pickands, Mather & Co. His headquarters are at 1255 Telephone building, St. Louis.

Mr. Desparois, for the past 2 years, has been identified with Hickman-Williams & Co. at St. Louis. Previously he was associated with the St. Louis Coke & Gas Co. for 8 years. Mr. Desparois gained considerable practical experience in foundries through 12 years' connection with the American Radiator Co., during which time he occupied the position of superintendent in several plants.

Louis J. Desparois

♦ ♦ ♦

HENRY WILSON recently was appointed foreman, Metropolitan Iron Foundry, Brooklyn, N. Y.

♦ ♦ ♦

KENNETH S. VALENTINE has been appointed district manager in New York for the Patterson Foundry & Machine Co., East Liverpool, O.

♦ ♦ ♦

R. J. ECKSTEIN has been appointed manager of the Cleveland branch of Cutler-Hammer Inc., Milwaukee. Mr. Eckstein became associated with the company 25 years ago, starting at the Milwaukee plant in 1911, and working through practically every department. A major portion of his career has been devoted to the application of electric control to motors in every phase of industry. His offices will be located at 1405 East Sixth street, Cleveland.

♦ ♦ ♦

ROBERT B. SKINNER has resigned as secretary-sales manager of the Skinner Chuck Co., New Britain, Conn., to become associated with LUCIUS E. WHITON, president, in the D. E. Whiton Machine Co., New London, Conn., manufacturer of chucks.

Mr. Skinner has been in the chuck business since leaving school, learning the trade in the factory. His outside interests are numerous.

Lucius E. Whiton

David E. Whiton, founder of the D. E. Whiton Machine Co. was born in West Stafford, Conn. in 1825 and began business there in 1856. The Whiton Co. was incorporated in 1884 with his son Lucius Whiton, as an officer. It was removed to New London, Conn. in 1884.

♦ ♦ ♦

H. FLEISHOUR, formerly connected with the W. A. Jones Foundry & Machine Co., Chicago, has been made general foundry foreman, Davenport Machine & Foundry Co., Davenport, Iowa.

♦ ♦ ♦

CLARENCE W. HOWAT has resigned as first vice president of the Pittsburgh Steel Foundry Corp., Glassport, Pa. Mr. Howat became affiliated with that company in an executive sales capacity in 1923, and in 1925 he became first vice president. He has been identified with the steel castings industry for 25 years, serving in both production and sales capacities.

♦ ♦ ♦

WALTER J. MILLER, who has been Pittsburgh district manager of sales and production of the American Steel Foundries, since 1930, has resigned to become president and general manager of Keokuk Steel Casting Co., Keokuk, Iowa.

OWSLEY BROWN, president of the Springfield Boiler Co., Springfield, Ill., and chairman and president of the Keokuk company, retains a substantial interest and is to be first vice president under the new arrangement.

WALTER O. PARHAM, long associated with Mr. Miller, is second vice president, and EDWARD J. WALSH, who has been works auditor in the Pittsburgh district for the American Steel Foundries since 1926, goes to the Keokuk company as secretary and treasurer.

Robert B. Skinner

Mr. Miller has been engaged in the steel foundry business since his graduation from the University of Minnesota in 1914. His connection with American Steel Foundries, and that of Mr. Parham, began in 1928 when that company acquired Northwestern Steel & Iron Corp., Minneapolis, of which Mr. Miller was president, and Mr. Parham, vice president.

♦ ♦ ♦

C. PAUL CLARK, formerly general manager of Clark Bros. Co., Olean, N. Y., manufacturer of oil and gas engines, has been elected president to succeed Joseph S. Reid, recently deceased.

Other appointments include F. H. LIGHT as secretary-treasurer, and J. B. O'CONNOR as vice president.

♦ ♦ ♦

ARTHUR E. SCHOEBECK recently was elected president of the Jamestown Malleable Iron Corp., Jamestown, N. Y. The following were elected directors for a term of three years: OSCAR A. LENNA, FRANK O. ANDERSON, and WILLIAM H. LAUSTERER.

STILL GOING STRONG!

Adams' Famous

UNIVERSAL PORTABLE RIDDLE (Patented)

The best known portable riddle made for foundry use . . . it has won its place on Performance!

- LIGHT WEIGHT—Only 65 lbs. One man can handle it easily.
- STURDY—Stands up under rough daily usage.
- PROTECTED MOTORS—Fully encased and dustproof.
- READY FOR INSTANT USE—Just hook it over any trolley or ring bolt and it is ready to go.
- 21-INCH RIDDLE (Mesh to requirements)—Quickly detachable, quickly changed. All riddles equipped with safety ground wire.

$135.00 f.o.b. Chicago

Standard equipment: A.C. 115-volt, 60-cycle, single phase. Wood riddle, any mesh.
Slightly higher priced when furnished for D.C. 3-phase or special motors.

And That Sturdy Little Worker

. . . The Original Adams RED ELECTRIC VIBRATOR

Abandon Makeshift
REPAIRS

Efficient production demands efficient equipment. "Good enough" is OUT from now on! Entrust your Vibrator and Riddle Repairs to our men . . . they are trained to the job.
SHIP THEM DIRECT TO US. Bill through your regular foundry supply house if you so desire. It will cost you no more . . . and you will know the job is done RIGHT!

Unexcelled for any type of core and mold work. Quickly pays for itself in faster and better molds, clean-cut draws. Lowest operating cost, most reliable service. Dust proof. Made in four sizes, consecutively doubled in capacity. With safety ground wire, $1.00 extra.

New Low Prices

No. 1—Light match plate $10.00
No. 2—Medium match plate . . 13.00
No. 5—Heavy match plate, tub and bench work 17.00
No. 9B—Machine and heavier 24.00*
*With cable; $21.00 without cable.

Order by number and specify correct voltage and cycle.

FOUNDRY SUPPLIES MANUFACTURING CO.

2221 Orchard St. **Chicago, Ill.**

400 Attend Birmingham Meeting

A. F. A. chapter formed at joint conference with the A. S. M. E. on foundry practice

WITH a registered attendance of 400 foundrymen and engineers from the southern states, and with some representatives from cities of the north, the Fourth Joint Foundry Practice meeting, sponsored by the Birmingham Section of the American Society of Mechanical Engineers with the American Foundrymen's Association co-operating, was by far the most successful of the series, the attendance greatly exceeding the previous mark of 250, and with technical sessions pronounced as the most interesting and valuable.

This gathering of foundrymen was made the occasion for the formation of a chapter of the A. F. A. which is to be known as the Birmingham District Chapter. L. N. Shannon, vice-president of the Stockham Pipe Co., Birmingham, was elected chairman. The other officers and directors elected were: Vice-chairman, W. Lee Roueche, McWane Cast Iron Pipe Co., Birmingham; secretary-treasurer, R. R. Deas, American Cast Iron Pipe Co., Birmingham; Directors—J. S. Bridges, United States Pipe & Foundry Co., Birmingham, Arthur C. Smith, Hardie-Tyne Foundry Co., Birmingham, William Oberhelman, Hill & Griffith Co., Birmingham, John W. Porter, Alabama By-Products Corp., Birmingham, C. L. Bransford, Republic Steel Corp., Birmingham, Karl Langrebe, Tennessee Coal, Iron & Railroad Co., Birmingham, and Charles Hamilton, Alabama Pipe Co., Anniston. The chapter starts off with some 80 members as announced by Mr. Shannon, the largest charter roll of any A. F. A. chapter. The nominations for officers and directors were presented by a committee of which the chairman was Russell Hunt, Sloss-Sheffield Steel & Iron Co.

The two day conference closed with a banquet at which there were some 300 engineers and foundrymen. Presiding was Joseph W. Eshelman, chairman of the Birmingham Section of the A. S. M. E. with W. Carson Adams as toastmaster. The guest speaker was W. L. Batt, National President of the American Society of Mechanical Engineers and president of S. K. F. Industries, Inc. of Philadelphia. Mr. Batt, in his talk said he was greatly impressed with the possibilities of the South to become the greatest section of the country in a few years, with its climate, mineral resources and proximity to the seaports of the South which offered splendid possibilities for manufacturing. He further said that he was impressed by the splendid engineering schools, which have the finest equipment and instructional staffs.

Mr. Batt defended the engineering profession from the charge of being responsible for the present unemployment situation. The changes brought about by engineers, he said, have created more jobs than have been displaced. The effect of the machine age has been to make work not unemployment. Unemployment, he said, has been caused by failure to adjust correctly the problems of distribution and production. Mr. Batt said further that the problem of unemployment could be more easily solved if employers would apply the golden rule in their relationship with their employees.

Technical Papers Presented

Mr. Eshelman, on behalf of the A. S. M. E. presented to Mr. Shannon, the chairman of the newly formed chapter of the A. F. A., a gavel, and with it the best wishes of the A. S. M. E. section and hopes for continued cordial co-operation between the two organizations like that which had made the meetings possible.

The Joint Foundry conference was opened with registration at the Tutwiler Hotel, the first session having as its chairman, T. G. Johnston, Republic Steel Corp. George R. Ozley, plant engineer, Alabama By-Products Corp., presented a paper on "Problems in the Manufacture of Foundry Coke." The discussion revolved around the deterioration of coke in stock piles and sulphur spots.

The second paper of this session was on "Grinding in the Foundry" by B. N. Hodges, of the Carborundum Co. Problems of pipe grinding were stressed in the discussion.

At the luncheon held on Thursday, James L. Wick Jr., vice-president of the A. F. A., presented a message of greeting from the association to the group and discussed management of a foundry in relation to technical advancements being made. He stressed the need for employers to reward employees in proportion to the returns of the business. He further stressed the advantages to be gained by management in taking advantage of the information being presented in papers before the association in satisfying customers with improved products. He stated he believed that sales management had not measured up to improvements in products and production methods. He thought that a field for the A. F. A. was to explore the field of education in developing men for management. R. E. Kennedy announced plans for the coming convention of the A. F. A. in Detroit.

At the second technical session V. A. Crosby, Climax Molybdenum Corp., Detroit, presented a very comprehensive discussion of the field of alloys in cast iron to enlarge the field of castings in satisfying the needs of engineers. A second paper was presented by G. O. Stanley, Dortch Stove Works, Franklin, Tenn. Mr. Stanley gave a detailed description of the problems met in installing a continuous pouring system in his foundry.

The morning session of the second day was devoted to a discussion of sand control and testing with H. W. Dietert, U. S. Radiator Co., Detroit, presenting a paper which brought out an extensive discussion. Walker Reynolds of the Alabama Pipe Co., Anniston, presided.

The concluding technical session of the meeting was on the *Cast Metals Handbook*. W. O. McMahon, Sloss-Sheffield company, presided. James T. McKenzie, American Cast Iron Pipe Co., as leader reviewed the cast iron section. Fred B. Rigan and Lee Everett, Stockham Pipe & Fittings Co. reviewed the malleable and steel sections respectively. James L. Wick Jr. discussed the nonferrous section. R. E. Kennedy gave a brief history of the formation of the book and its purpose. The discussion brought out the need of the engineer for greater information on factors of designing for castings.

ADVERTISING PAGES REMOVED

Hold Sectional Meeting at Michigan State

Interesting discussions at one day meeting consider experiments on superheating iron

INTERESTING opinions on the effects of superheating upon the physical properties of gray cast iron were developed at the annual foundry short course held at East Lansing, Mich., on Feb. 7 under the auspices of Michigan State college, the American Foundrymen's association, and the Detroit chapter of the American Foundrymen's association. Approximately 100 foundrymen attended the 1-day session.

Practically the entire discussion at the meeting revolved around a report "The Properties of Gray Iron Castings as Affected by Superheating Temperatures," which was prepared by M. F. Surls and F. G. Sefing at the Michigan Engineering Experiment station located at Michigan State college. The paper was presented by Mr. Surls at the morning session presided over by W. H. Spencer, Sealed Power Corp., Muskegon, Mich. Based upon the data collected in the experiments, covering a 2-year period, the authors have presented the following conclusions:

Results Are Recorded

1—The superheating of gray cast iron mixtures results in little or no increase in the strength of the metal provided the chemical analysis remains constant.

2—Gray irons heated to 2900 degrees Fahr. or above show a definite dendritic formation when the carbon content is 3 per cent or below.

3—Superheated irons show a dendritic structure when poured into light sections and a normal structure when poured into heavy sections.

4—Presence of a dendritic structure causes decrease in strength of gray iron.

5—Heating to superheating temperatures and holding the bath at those temperatures causes an increase in strength, a loss of carbon and a gain in silicon. Much of that increase in strength can be attributed to the change in analyses.

V. A. Crosby, Climax Molybdenum Co., Detroit, presented the second paper at the morning session on "Structures of Gray Iron and Their Effects on Physical Properties." Mr. Crosby spoke briefly on the various structures found in cast iron, illustrating his paper with a large number of slides. He discussed the strengthening effect of silicon on cast iron and stated that the study on superheating is complicated by various factors in addition to time and temperature. Mr. Crosby showed that it is difficult to predict strength properties from a study of the microstructure.

In the discussion which followed, H. S. Austin, Buick Motor Co., Flint, Mich., stated that it is dangerous to go too high with the silicon in castings which have variations in sections. In small castings, 2.65 to 2.70 per cent is likely to be dangerous when castings have irregular sections. In answer to a question from the floor, Mr. Crosby stated that he was in favor of employing irons having particular structures for certain definite applications. Harry Rayner, Dodge Bros., Detroit, expressed the opinion that if the carbon content could be held low, high silicon iron would prove better for cylinder block castings. Others agreed with that contention.

Armand Di Giulio, Ford Motor Co., Dearborn, Mich., presented the first paper at the afternoon session on the "Effects of Superheating Temperature Alone on Gray Iron Mixtures." Fred J. Walls, International Nickel Co., New York, presided. In introducing his discussion, Mr. Di Giulio questioned several phases of the test procedure folowed by Mr. Surls and Mr. Sefing. He questioned the use of the optical pyrometer in measuring the temperature inside the electric furnace.

The speaker then discussed certain parts of a paper, "Factors Affecting the Structure and Properties of Gray Cast Iron" presented at the Toronto convention of the A.F.A., and representing work carried on at the University of Michigan, Ann Arbor, Mich. by Mr. Di Giulio and A. E. White. In that test, conducted in an indirect arc type electric furnace with metal charged consisting of 90 per cent remelt and 10 per cent steel scrap, it was found that superheating produced improvements in the physical properties of the iron. This improvement was approximately 8.5 per cent.

A criticism of the research paper by Mr. Surls and Mr. Sefing, prepared by H. W. Gillett, Battelle Memorial institute, Columbus, O., was read by V. H. Schnee, also of Battelle. E. K. Smith, Electrometallurgical Co., Detroit, pointed out that it is impossible to make all of an investigation perfect and stated that in his opinion the authors had made a valuable contribution to the subject. A. H. Dierker, research engineer, Ohio State university, Columbus, stated that work on the subject of superheating has been underway at the university but that no results have been published because as yet it has ben impossible to arrive at a point where the composition of the metal at the superheating temperatures could be held constant.

Effect of Time Studied

Considerable discussion was centered on the time for adding ferrosilicon to the metal. Mr. Di Giulio pointed out that in his tests, the ferrosilicon addition was made 10 minutes before the furnace was tapped. He also stated that the tests were carried on with a furnace rather tightly sealed when operated. R. H. Bancroft, Perfect Circle Co., Newcastle, Ind., stated he has encountered a silicon pickup when superheating iron. Prof. Sefing pointed out that no carbon drop was experienced in the heats which were brought to the superheating temperature and tapped immediately. However, a carbon drop was experienced when the metal was held at that heat for a predetermined time.

In a paper, "The Effect of Time at Superheating Temperatures on Gray Iron Mixtures," H. S. Austin described work which he has done on superheating and the effect of properties on holding time. He stated that his tests show holding gray iron at 2900 degrees Fahr. invariably produced an inferior metal, the condition of the metal depending upon the length of time at which the heat was

held. He stated that in duplexing, where the metal is melted in the cupola, and refined in the electric furnace, this does not apply. In his opinion, it is not good practice to hold any iron for any period of time at high temperatures. Mr. Austin discussed the use of test bars and stated that in his opinion it is advisable to use a size of bar test suited to show the true qualities of the particular type of iron under test.

Harry Rayner presented a paper "Relation Between Superheating, Size of Section and Structure" in which he drew the conclusion that size of section of superheated iron is not as great a factor in determining the structure of the casting as composition of the metal, degree of superheat, pouring temperature, length of time metal is held above critical superheating temperature, method of gating of the mold and the cooling rate after the metal is cast.

Mr. Rayner stated that a great many casting defects had been eliminated by the use of superheated irons. Blowholes in large sections, chilled or cold shut thin sections, and shrinkage between thick and thin sections due to uneven cooling have been practically eliminated. Superheating plain cast iron has the effect of making large section castings of uniform texture throughout the entire cross-section, materially strengthening the casting. In the discussion, A. E. Rhodes, Detroit Electric Furnace Co., Detroit, stressed the point that the rate of feeding of certain castings has much to do with the final properties secured from superheated iron.

Mr. Rayner, in response to the question concerning the type of steel used, stated that his company now is using baled sheet steel. While some doubt was experienced when the use of that material first was proposed, it has been found highly satisfactory and the foundry now tries to use as much as possible in the charge. A higher coke bed is used in melting that material.

Cast Iron Discussed

Several present offered suggestions in response to a question as to what constitutes superheated iron, including the following: H. H. Judson, Gould's Pumps Inc., Seneca Falls, N. Y.; W. H. Spençer; Fred J. Walls, and Armand Di Giulio.

The evening session was preceded by dinner at which Vaughan Reid, City Pattern Works, Detroit, and chairman of the Detroit Chapter of the A.F.A., presided. Following the dinner, Mr. Reid introduced the various speakers and chairmen who had presided at the sessions. Those present were welcomed to the college by Dean H. B. Dirks of the college of engineering and head of the experiment station, Michigan State college. Robert E. Kennedy, technical secretary, American Foundrymen's association, outlined plans for the coming convention and exhibition of the association.

R. G. McElwee, Vanadium Corp. of America, Detroit, presented a discussion on "The Influence of High Furnace Temperatures on the Chemical Analysis and the Effect of Small Changes in Analysis on the Physical Properties of Gray Cast Iron." Mr. McElwee pointed out that while considerable discussion centered around the holding of the metal at superheated temperatures, he doubted if from the practical point of view anyone would hold the heat. In the foundry, it has been the policy to heat the iron to the desired point and then get it in the mold as soon as possible. The speaker discussed certain irons presented in the report of Mr. Surls and Mr. Sefing which seemed to him to be abnormal to the remaining irons in the group, or to irons normally used in foundry practiie. He stated that with irons containing a low amount of carbon, it has been the policy to add silicon just before tapping to secure the best possible physical properties. He said that this is common practice, not only with the electric furnace, but with the air furnace. Mr. McElwee also suggested that further tests be undertaken to see what effect the dendritic structure may have on the subsequent heat treatment. He urged the greater use of the Maurer diagram in studying the relation of carbon and silicon within a certain range.

Following Mr. McElwee's paper, Mr. Sefing gave the authors' closure and stated that various papers and discussions would be printed as a bulletin of the Michigan State Experiment station.

Reader's Comment

EDITOR'S NOTE—*Material Appearing Under this Head Does Not Necessarily Reflect the Opinion of* THE FOUNDRY *or of Its Editors.*

Silicon Increase

TO THE EDITORS:

On page 38, of the February issue of THE FOUNDRY there is a statement made with which we have to take issue. Under the heading "Silica Brick Is Not the Cause of Defects" there is mentioned some trouble that one of your readers has been having with castings breaking, and the metallurgist of that foundry claimed that the silica brick used in patching their melting zone was the cause of the difficulty.

You disagreed with his statement. The fact is that we have been giving considerable thought to this subject, and we have found in a number of foundries where silica sandstone rock was used in the melting zone of the cupolas that they frequently had trouble with hard spots in castings and with breakage in the castings. When the trouble was analyzed, it was found that the hard spots were due to an increase in silicon. It is our contention that conditions are such in the melting zone of the cupola that silicon can be reduced from the silica in either a silica brick, or sandstone blocks. This was brought out recently in a paper by Dierker, published by the A.F.A., and the subject is to be given a thorough airing at the forthcoming convention of the A.F.A. in the session on refractories.

The silica that occurs in a cupola block is chemically combined with the alumina, and clay brick when used for patching does not cause this trouble, but as stated above, we know of numerous instances where sandstone used for patching the melting zone has caused the trouble your reader speaks about. Silica brick would cause the same difficulty.

C. B. BALES,
Vice President

Ironton Fire Brick Co.
Ironton, Ohio

One Most Desired

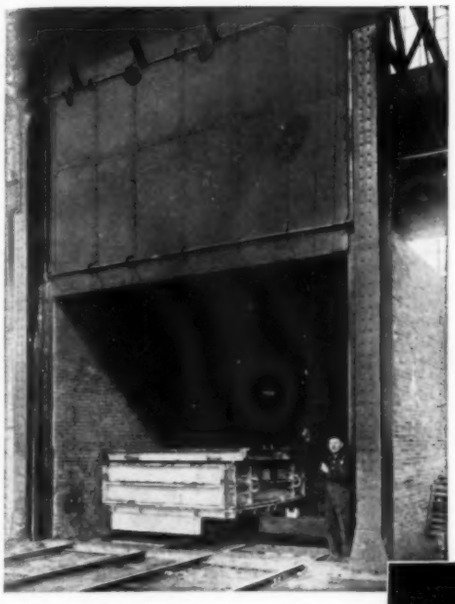
TO THE EDITORS:

At this opportunity I take the pleasure to write you a few words about THE FOUNDRY. Of all the American and European trade publications it is the one desired most here in Soviet Russia. The important articles are duly translated and interpreted. Advertisements are very useful to us as they are the only chance to bring us in touch with the most modern foundry equipment and the latest developments in the foundry industry. I am sure if it were not for the Valuta problem you would have many more subscribers from here.

I am very anxious to read Pat Dwyer's *Gates and Risers* and I ordered one volume for our library, which I hope will come in a few months due to red tape in ordering foreign books.

GUSTAVE WOHLFELD
Assistant Foundry Supt.
Kharkov Tractor Plant
Kharkov, USSR, Russia

Burgess-Parr Co. division of C. F. Burgess Laboratories, Inc. has moved from Moline, Ill., to Freeport, Ill. C. A. Jurack is manager.

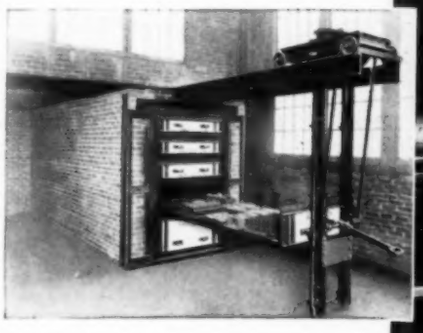


Typical Installation of Large Coleman Car Type Oven

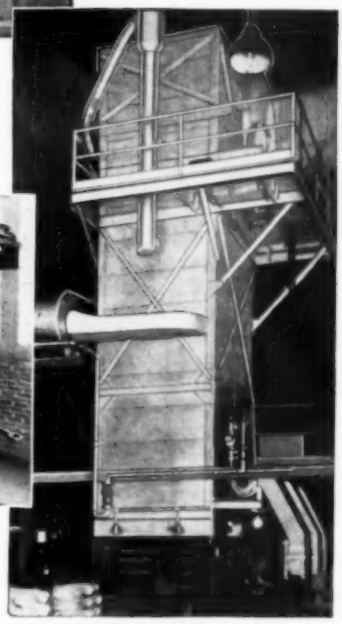
For Fast, Uniform and Low Cost Baking

COLEMAN
CORE & MOLD OVENS

The importance of installing the most modern core and mold oven equipment in the successful operation of the present day foundry cannot be over emphasized.



Coleman Rolling Drawer Core Oven

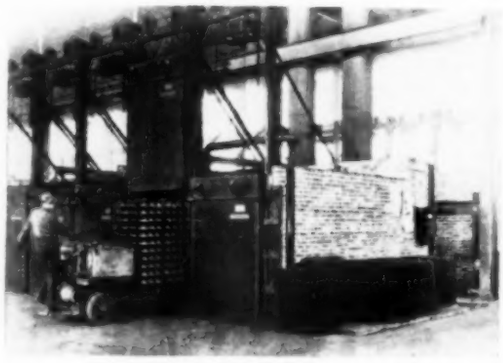


Coleman Vertical Conveyor Oven

Regardless of the sands and binders that you use, your cores cannot be right unless they are baked right. Coleman Ovens assure a dependable production of uniformly good cores and properly dried molds at lowest cost for fuel, labor and maintenance.

Coleman controlled heating system provides the greatest flexibility of operation to meet varying core baking or mold drying requirements. Absolute satisfaction is assured with whatever fuel is most economically obtainable at your plant.

Whether your work involves the drying of the very largest molds, the baking of unusual quantities of cores for mass production, or the limited production of small or delicate cores, Coleman Insulated Brick or Metal Insulated Steel Ovens can be furnished to most efficiently handle your particular requirements.



Battery of Coleman Insulated Brick Portable Rack Type Ovens

Built in all types and sizes

Rolling Drawer Ovens	Portable Rack Ovens
Car Type	Conveyor Ovens
Shelf Type Ovens	Special Ovens

For operation with any fuel—coke, coal, oil, gas or electricity

WRITE FOR COMPLETE CATALOG

The FOUNDRY EQUIPMENT Co.

Builders of Coleman and Swartwout Ovens
Contracting Engineers and Manufacturers
CLEVELAND, OHIO

Shrinkage

by H. A. Schwartz

Fifth Installment

Problem 11.

CALCULATE the excess of temperature of feeder metal over casting metal for a given radius of cylindrical casting, cylindrical feeder and cylindrical mold so that the feeder may freeze after the casting.

If θ_1 and θ_2 represent the initial temperatures in the two cylindrical members of different cross section and p_1 and p_2 represent the corresponding values of p, then if the two parts are to freeze in equal times,

$$\frac{(\theta_1-\theta_f)p_1^2}{\theta_1}\log_e p_1=\frac{(\theta_2-\theta_f)p_2^2}{\theta_2}\log_e p_2 \qquad (3)$$

That section for which an expression of the above form is greatest will freeze last. If p_1, p_2 and θ_f are known, evidently the value of θ_1 corresponding to any desired value of θ_2 can be simply calculated[38].

Problem 12.

Calculate the diameter of cylindrical feeder required for a cylindrical casting produced in a cylindrical mold of a metal freezing at a single temperature but having both a finite latent heat of fusion and change of volume on freezing.

The cooling rate of the metal at temperature θ' is

$$\frac{2k}{\theta_0(p R_m)^2\rho c}(\theta')^2 \qquad (*)$$

From the latent heat of fusion of a metal and its specific heat at the melting point we can, as we have so often done already, compute the temperature interval equivalent in heat content to the change of state and can then calculate the time interval during which the temperature would fall by that amount if the cooling rate remained, as it does, that for the temperature θ' [40].

The time during which the temperature remains stationary is given by the expression

$$t=\frac{L_f\theta_0(p R_m)^2\rho}{2k\theta_f^2} \qquad (4)$$

where L_f is the latent heat of fusion of the metal, θ_0 the pouring or initial temperature, ρ the density of the metal, θ_f its melting point and k the thermal conductivity of the sand. R_m is the mold radius and $(p R_m)$ is the radius of the concentric cylindrical object which is freezing.

The time for the casting to become completely frozen is then

$$-\frac{\theta_0-\theta_f}{\theta_f}\cdot\frac{(p R_m)^2\rho c\log_e p}{2k}+\frac{L_f\theta_0(p R_m)^2\rho}{2k\theta_f^2}$$

or

$$-\frac{(p R_m)^2\rho[L_f\theta_0-\theta_f(\theta_0-\theta_f)c\log_e p]}{2k\theta_f^2} \qquad (5)$$

Footnote references will be found at the end of this installment starting on page 58.

If we wish to make the ultra conservative assumption that the feeder shall not *begin to freeze* before the casting is frozen then we may write the time to reach the freezing point of the feeder as equal to the time for complete freezing of the casting and obtain by further manipulation[41] the expression

$$p_2\log_e p_2=p_1^2\left[\log_e p_1-\frac{L_f\theta_0}{\theta_f(\theta_0-\theta_f)c}\right] \qquad (6)$$

in which p_2 and p_1 are respectively the ratios of the radius of feeder and casting to the mold radius.

We thus see that for the conditions here assumed, i.e., that the feeder shall not begin to freeze before the casting is completely frozen the ratio of feeder to casting diameter depends not only upon L_f, θ_f and c which are constants for any given metal, but also upon the pouring temperature θ_0 which is variable and upon the thickness of sand surrounding the casting which determines p_1 and p_2 for any given casting dimensions. The feeder diameter must be larger, other things being equal, the hotter the metal is poured.

Fig. 25 is convenient in the solution of equation (6). In Table III are given the values of the expression $\frac{L_f}{\theta_f c}$ and $\frac{\rho c}{2k}$ for the three pure metals so far considered cast in sand molds whose exterior is assumed to be 50 degrees Cent.

Table III.

	$\frac{L_f}{\theta_f c}$	$\frac{\rho c}{2k}$
Aluminum	.613	78.4
Copper	.529	109.8
Iron	.442	111.9

Specific heats having been taken at room temperature the values in the first column are somewhat too high, those in the second somewhat too low.

It is perhaps doubtful whether our various assumptions are not in any event so uncertain that for foundry purposes $\frac{L_f}{\theta_f c}$ may not as well be taken as ½ and $\frac{\rho c}{2k}$ as about 100 in the absence of precise knowledge.

The expression $\frac{\theta_0}{\theta_0-\theta_f}$ which also occurs frequently, will in practice have a value ranging from 4 to 10. The fact that this value is unpredictable when making a pattern is another reason why too great refinement in the calculation of $\frac{L_f}{\theta_f c}$ is foolish.

For the purpose of this problem 12 it is not necessary to have the feeder freeze so slowly. Consider the cylindrical casting and cylindrical feeder, the latter co-axially on top of the former, while they solidify. We have already seen

(*Continued on page 57*)

(*Continued from page* 54)

that the void left in the casting if there were no communication between feeder and casting during freezing would be represented by the contraction of the metal during freezing. At this time there must be left enough liquid metal in the feeder so that if a connection were then established the liquid would at least fill the void. Consider now the condition in the feeder when it is partially frozen. Let x be the fraction of the metal which has solidified; let ϕ be the fractional change in volume of the metal on solidification. Then per unit height of feeder corresponding to a total volume of $2\pi R_2^2$, there has resulted a volume of solid $2\pi\, x\, R_2^2$, a volume of liquid $2\pi(1-x)R_2^2$ and a void $2\pi\phi\, x\, R_2^2$. Since the liquid tries to fill the void, its upper level will have dropped so that for unit height of feeder there will be

$$\frac{2\pi(1-x)R_2^2}{2\pi(1-x)R_2^2+2\pi\phi\, x\, R_2^2} = \frac{1-x}{1-x+\phi x} \text{ height of liquid.}$$

If the ratio of feeder height to casting height be y, then the height of liquid will be $\frac{y(1-x)}{1-x+\phi x}$ times the height of the casting. If now at the moment of freezing of the casting there shall be just enough liquid in the feeder, the fraction x of which is frozen, we may say in terms of unit height of casting,

$$2\pi\phi R_1^2 = 2\pi(1-x+\phi x)R_2^2\,\frac{y(1-x)}{1-x+\phi x}$$

$$\phi R_1^2 = y(1-x)R_2^2$$

$$y\, x\, R_2^2 = y\, R_2^2 - \phi R_1^2$$

$$x = \frac{y R_2^2}{y R_2^2} - \frac{\phi R_1^2}{y R_2^2}$$

which remembering the definition of p_1 and p_2 and simplifying somewhat, becomes

$$x = 1 - \frac{\phi p_1^2}{y p_2^2} \text{ or } 1 - \frac{\phi}{y}\left(\frac{R_1}{R_2}\right)^2$$

Since at constant temperature the metal loses heat at constant rate it freezes at a constant rate so that from equation (4) the time to reach this condition is

$$\left(1-\frac{\phi\, p_1^2}{y\, p_2^2}\right)\frac{L_f\theta_0(p_2R_m)^2\rho}{2\,k\,\theta_f^2}$$

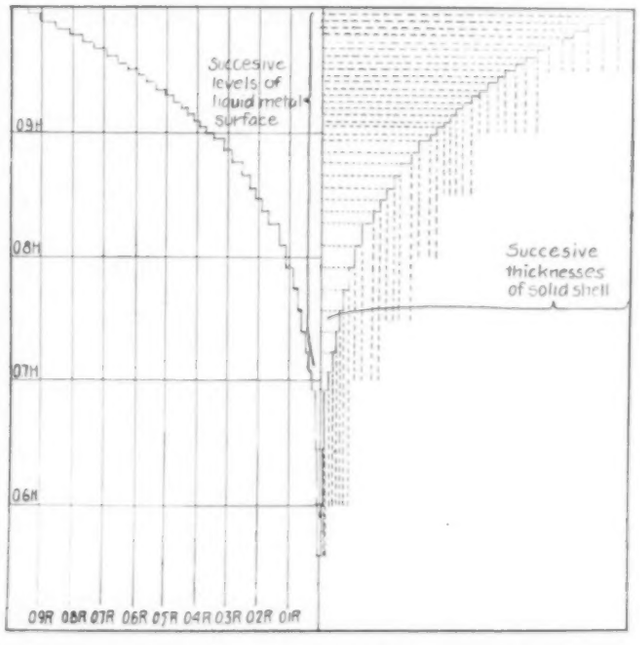


Fig. 26 suggests the pipe in a vertical ingot cooling under assumed conditions will extend clear to the bottom

after the freezing point has been reached. The time for the casting to reach the freezing point plus its freezing time must be the same as for the feeder to reach the freezing point plus the time for the fraction, x, of the feeder to free, hence

$$\frac{\theta_f-\theta_o}{\theta_f}\,\frac{(p_2R_m)^2\rho\, c\, \log_e p_2}{2\,k} + \frac{L_f\theta_o(p_2R_m)^2\rho}{2\,k\,\theta_f^2} =$$

$$\frac{\theta_f-\theta_o}{\theta_f}\,\frac{(p_2R_m)^2\rho\, c\, \log_e p_2}{2\,k} + \left(1-\frac{\phi\, p_1^2}{y\, p_2^2}\right)\frac{L_f\theta_o(p_2R_m)^2\rho}{2\,k\,\theta_f^2}$$

which may be rearranged to give

$$y = \frac{\phi}{\theta_f}\,\frac{p_1^2 L_f\,\theta_o}{(\theta_f-\theta_o)(p_2^2\log_e p_2 - p_1^2\log_e p_1)} \qquad (7)$$

or

$$p_2\log_e p_2 = \frac{\phi}{y\,\theta_f}\,\frac{p_1^2 L_f\,\theta_o}{\theta_f-\theta_o} + p_1^2\log_e p_1 \qquad (8)$$

from which either y or $p_2\ log_e\ p_2$ can be calculated using Fig. 25 if the other and p_1, ϕ, L_f, θ_0 θ_f are known as they are if the mold size and kind of metal are known.

In view of the impossibility of realizing all the assumed conditions probably the useful values will lie between the value calculated as above and that calculated on the assumption that the feeder has not begun to freeze when the casting is solid.

In discussing problem 12 we made the simple but inexact assumption that the upper surface of the open feeder would remain a horizontal surface. Everyone knows that feeders when kept from freezing over have a funnel shaped depression in their upper surfaces and that the pipe in an ingot is shaped like a carrot or turnip. The simple assumption does not introduce an error into problem 12 of sufficient magnitude to be of importance compared with the uncertainties of the rest of the problem. It is, nevertheless, interesting and of a little practical importance to examine the form which the upper surface will take.

Problem 13.

Required the form of the upper surface of an ingot of a pure metal which contracts by 5 per cent of its volume on freezing if the ingot freezes without sensible temperature gradient.

It will probably be simpler to plot the curve from a series of arithmetical calculations than to develop a calculus solution[42].

Consider the height of the ingot to be unity. If say 1/10 of the ingot has frozen, i.e when the solid shell has attained a thickness of $1-\sqrt{.90}$ times the outer radius or 0.051 times that radius, the shrinkage in volume corresponds to 0.005 of the volume of the cylinder or 0.00555 of the liquid metal and the level of the metal must therefore fall to 0.99445 of its original height of unity to make up this shrinkage. When 1/10 of the remaining liquid freezes, corresponding to the solidification of a liquid layer whose thickness is 0.051 × 0.949 of the radius of the ingot the level falls to 0.99445 × 0.00445 of the original height and so on. The successive steps are plotted in Fig. 26. If the ingot freezes also from the bottom, as all ingots do in practice, then the entire line is slightly further depressed more at the center than at the rim by an amount depending on the rate of length to height of the ingot.

Fig. 26 suggests and equation (9) of the last footnote demonstrates that the pipe in a vertical cylindrical ingot cooling under the assumed conditions will extend clear to the bottom ($h=0$ when $r=0$ in the equation). If, nevertheless, such ingots appear sound at the bottom the reason is three fold. The lower portion of the pipe is merely an extremely thin thread and escapes detection, the ingot cools also from the bottom and, most important of all, an ingot poured from the top is colder at the bottom than at the top so that the inner edge of the frozen shell is not a cylinder but a part of a conical surface smaller at the top

than at the bottom which alters the freezing condition significantly.

We are now in a position to consider the feeding of a vertical cylindrical casting by a cylindrical feeder of larger diameter placed directly above it, the axes of the two cylinders being the same from the viewpoint of the drawing down of the upper feeder. This is a somewhat different limitation from that considered in problem 11 in relation to the question of feeding.

(To Be Continued)

[38] The equation (3) can not be cast into a form involving only the ratio of p_1 to p_2 hence the relative values of initial temperature do not involve only the ratio of cylinder diameters but also the size of the mold.

[39] In the derivation of the time required to reach a given temperature we had the expression

$$-\frac{2\pi k\theta'}{\log_e p}\,t = (\theta - \theta')\,\pi R^2 \rho c$$

hence

$$t = -\frac{\theta' R^2 \rho c \log_e p}{2k\theta'} = -\frac{R^2 \rho c \log_e p}{2k}$$

$$dt = -\frac{\theta' \pi R^2 \rho c \log_e p}{2\pi k}\, d\,\frac{1}{\theta'}$$

$$= \frac{\theta' R^2 \rho c \log_e p}{2k}\,\frac{1}{(\theta')^2}\, d\,\theta'$$

$$\frac{d\,\theta'}{dt} = \frac{2k(\theta')^2}{\theta' R^2 \rho c \log_e p}$$

$$= \frac{2k}{\theta' (pR_m)^2 \rho c}\,(\theta')^2$$

[40] This imaginary temperature interval $\Delta\theta$ will be $\Delta\theta = \frac{L_f}{c}$ hence the time during which the temperature remains stationary will be

$$\Delta\theta \div \frac{2k\theta_f^2}{\theta' (pR_m)^2 \rho c} = \frac{L_f}{c}\,\frac{\theta' (pR_m)^2 \rho c}{2k\theta_f^2}$$

[41]

$$= \frac{\theta - \theta_f}{\theta_f}\,\frac{(p_2 R_m)^2 \rho c \log_e p}{2k} = \frac{(p_2 R_m)^2 \rho [-\theta_f (\theta - \theta_f) c \log_e p + L_f \theta]}{2k\theta_f^2}$$

$$(\theta - \theta_f)\, p_2^2 \rho c \log_e p_2 = \frac{p_1^2 [\theta_f (\theta - \theta_f) c \log_e p_1 - L_f \theta]}{\theta_f}$$

$$= p_1^2 (\theta - \theta_f) c \rho \log_e p_1 - \frac{p_1^2 L_f \theta \rho}{\theta_f}$$

$$p_2^2 = p_1^2 \left[\frac{\log_e p_1}{\log_e p_2} - \frac{\rho L_f \theta}{\theta_f (\theta - \theta_f) \rho c \log_e p_2}\right]$$

$$p_2^2 \log_e p_2 = p_1^2 \left[\log_e p_1 - \frac{L_f \theta}{\theta_f (\theta - \theta_f) c}\right]$$

[42] Those who may prefer a more formal proof may consider a cylinder of radius, r, of liquid metal surrounded by a layer of solid of infinitesimal thickness, dr. Its volume is obviously $2\,\pi\,h\,r\,dr$ if the cylinder have a height of h and its loss in volume on freezing is $2\,\pi\,\phi\,h\,r\,dr$ if ϕ is the coefficient of contraction on freezing. If this volume is to be made up by a fall in level of the liquid by dh then the volume corresponding to this fall in level is $\pi\,r^2\,dh$ and

$$2\,\pi\,\phi\,h\,r\,dr = \pi\,r^2\,dh$$

$$2\,\phi\,h\,dr = r\,dh$$

$$2\,\phi\,\frac{dr}{r} = \frac{dh}{h}$$

Integrating

$$2\,\phi \log_e r = \log_e h + I$$

But if R be the radius of the ingot and H its original height, then also

$$2\,\phi \log_e R = \log_e H + I$$

$$I = 2\,\phi \log_e R - \log_e H$$

and

$$2\,\phi \log_e r = \log_e h + 2\,\phi \log_e R - \log_e H$$

$$\log_e r^2 \phi = \log_e \frac{R^2 \phi\, h}{H}$$

$$r^2 \phi = \frac{R^2 \phi\, h}{H}$$

Cost Discussion Features Ohio Meeting

Albert C. Grover, cost consultant and a member of the editorial advisory staff of THE FOUNDRY was the principal speaker at the regular meeting of the Northeastern Ohio chapter of the American Foundrymen's association, held Feb. 4 at the Cleveland club. Walton Woody, National Malleable & Steel Castings Co., presided.

Classifying foundries as jobbing, production, those operated in conjunction with machinery building plants or combinations of those, Mr. Grover pointed out that uniform casting methods can be employed for all, but consideration must be given to special conditions existing in each foundry. The present facilities of production in a foundry and past experience are the two major considerations in the standardization of costs; the molding operation being considered the basis, and capacity being referred to in terms of men and production hours, not tonnage.

The speaker then divided his subject into three elements for discussion, namely metal, production, and marketing, and proceeded from there to a more detailed consideration of each individual division. An analysis of production cost involves several elements such as depreciation, taxes, insurance, heating, lighting, etc., and several basic operations such as melting, coremaking, molding, tumbling, and cleaning, all of which must be given due emphasis. Any system must be elastic enough to apply to different conditions in different foundries.

Proceeding to his third division, marketing cost, the speaker stated that this may be broken up into shipping and selling, plus the elements previously mentioned, such as depreciation, taxes, etc., with the cost calculation emanating from an individual consideration of these factors. Accurate charts were shown, based on actual costs submitted by various foundries with reference to each of these divisions. The speaker emphasized the value of making enough tests to satisfy the figuring of rates. In regard to this, he showed again that it was necessary to consider cost from the viewpoint of material or molding labor, and not flat tonnage. After showing contrasting prices and examples of both ferrous and nonferrous shops, a general discussion followed.

Frank C. Cech, Cleveland Trade school, presented a short coffee talk on "Blueprint Reading and Job Planning," in which he discussed briefly the system of apprenticeship now employed by the school and emphasized the importance of co-ordinating the visual aspect of the blueprint and its practical application to the boy's own work in the shop.

R. E. Kennedy, technical secretary of the A.F.A., spoke briefly in regard to the national meeting of the association, to be held in Detroit, beginning May 4.

The next meeting of the chapter will be held on March 19 and will be devoted to "Brass Foundry Practice." An outing in June is planned by the Northeastern Ohio chapter of the American Foundrymen's association.

Foundrymen Study Nonferrous Practice

D. M. Curry, member of the development and research division of International Nickel Co. Inc., New York, spoke on the subject "Modern Foundry Practice in the Nonferrous Field," at the regular meeting of the Metropolitan Philadelphia Chapter of the American Foundrymen's association, held at the Engineer's club, Feb. 7.

Presenting his material in a practical manner and using numerous slides for illustration, the speaker discussed the most recent developments in the use of nonferrous alloys, the position of nickel in that field, the importance of proper molding sand and its condition, and foundry practice. He stated that molding sand control is a highly important factor in foundry work.

In his survey of the most recent methods of casting nonferrous alloys, Mr. Curry paid particular attention to the use of nickel bronze and nickel silver.

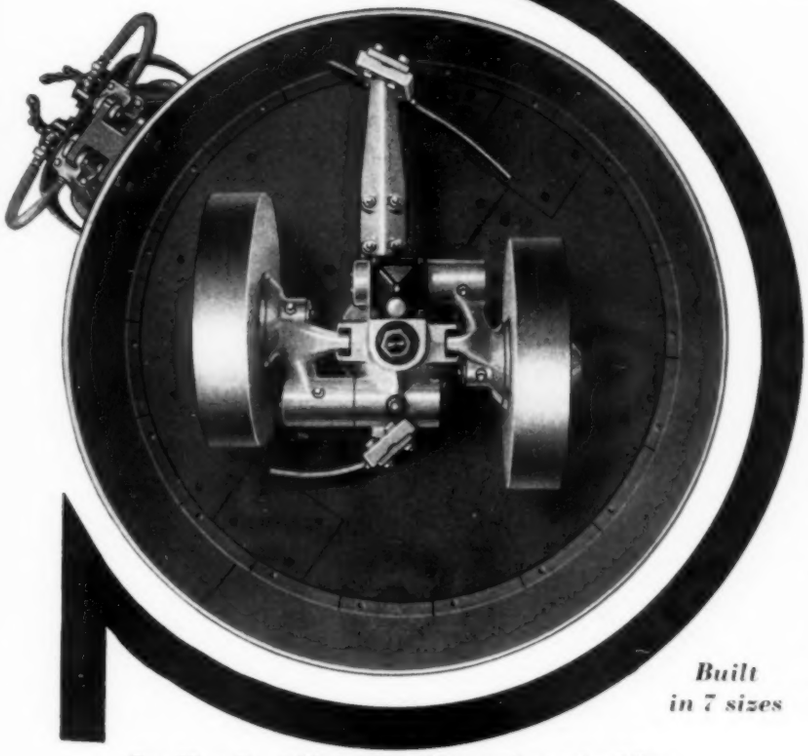
Many points of interest were brought up in the general discussion which followed the address by Mr. Curry.

SIMPSON

INTENSIVE MIXERS

for

CORE SAND PREPARATION



Built in 7 sizes

Top View No. 2 Mod. "H" Simpson Intensive Mixer

are being used successfully in several hundred foundries.

Users report that mulling their core sands in the Simpson Mixer results in many improvements and economies.

1. Uniform cores—virtual elimination of hard and soft spots.
2. Reduction of core breakage.
3. Reduction of scrapped cores.
4. 10-30% less oil for a required strength.
5. Up to 50% less cereal binder for a required strength.
6. Less power and fewer machines for a required production.
7. Low maintenance cost.
8. Reduction in scrap due to defective cores.
9. Increased flowability of the core sands.

The use of the latest design Simpson Intensive Mixer—anti-friction bearing equipped—offers foundrymen the opportunity to improve the cores while reducing the cost.

Investigate the advantages and economies possible in your foundry.

NATIONAL ENGINEERING COMPANY

MACHINERY HALL BUILDING *549 W. WASHINGTON BLVD.*

CHICAGO, ILL., U. S. A.

MANUFACTURERS AND SELLING AGENTS FOR CONTINENTAL EUROPEAN COUNTRIES:—THE GEORGE FISCHER STEEL & IRON WORKS, SCHAFFHAUSEN, SWITZERLAND.

New suits are air conditioned

The Adventures of BILL

By PAT DWYER

WELL sir," Bill remarked one bitterly cold night recently, "this certainly is one tough night." He stretched his long feet in front of the fire. "Yes sir, one tough night. The climate must be changing or something. Idenknow as ever I seen as bitter a night in any month from December to Febuaree. Wind go right through you. I'd hate to be cleaned out in a friendly little game tonight and have to go home in a barrel like some of these birds you see in the funnies. And speaking about barrels," he eyed me suspiciously. "I hope you haven't dug up any more tripe about 'em."

"Well," I said, "to borrow one of your favorite remarks, yes and no. According to well authenticated, if somewhat belated news reports, a dame named Helen had a face that launched a thousand ships when the Greeks set out across the foaming sea for their seven year siege of Troy."

"Some face," Bill commented sourly.

"Very neatly put indeed. Some face, sez you. However, we refuse to be diverted from the main issue, which is that this feat of building 1000 ships constitutes an all time record, not even exceeded by Hog Island in the war years of the shipbuilding industry. Shoe shining and restaurant activities suffered a serious setback during this period when every able bodied Greek plied hammer and saw, adze and calking mallet and drew down fat pay envelopes every Saturday night in the ship yards.

"Since this is a serious discussion we shall dismiss the insidious temptation to follow the boys in their drachma scattering peregrinations around the city with three or maybe four ports of call in every block. Before the advent of the shipyards it is quite probable that wine was served from stone vats. Development of a new and highly specialized technique in wood working changed all this. Men skilled in bending and joining curved planks in the hull of a ship to keep the water out, readily adapted the same technique and material to the construction of vessels for keeping liquids in, either temporarily, as on Saturday nights, or if necessary for longer periods.

"The old unsanitary custom of delivering wine in bulk, covered with a thin scum of dust, dead flies and horse hair, was superseded by the up to the minute custom of delivering the goods in a neat, tight, germ and dust proof container, a triumph of the wood worker's art, a container that has since traveled triumphantly down through the centuries, an object that has become indispensable in the fields of industry and transportation, an absolute necessity to the existence of civilized man. Gentlemen, the wooden barrel!

"By the time Diogenes, that sterling exponent of the simple life arrived on the scene, wooden barrels were so numerous and common that our hero adopted one as a permanent abode. The cubical content of this cute little nest has been approximated closely by the modern flat builder, thus demonstrating the truth of Diogenes' contention that a man can exist in a place that would smother a dog.

"However, the philosopher's coop was not cluttered up with a breakfast nook, telephone booth, h. and c. water and sewer connections and for that reason it may be said to have a slight advantage over the modern city apartment in size and convenience. The old boy, lantern in hand, could ooze into and out of his barrel without barking his shins, or without adopting the precaution of removing most of his outer garments.

"In the gradual course of evolution it is not altogether improbable to as-

(*Concluded on page* 63)

Visitors go round and round, Oh-o-o and come out heah!

ADVERTISING PAGES REMOVED

(*Concluded from page* 60)

sume that within the next two thousand years a national housing committee will develop a type of community building patterned on that of the ancient cliff dwellers, with the single exception that barrels will take the place of the cells. Choice apartments will be attached to the outside of the walls or under the eaves after the manner of swallow nests on the old red barn, medium size in old oak for the master, large one with several mirrors for the dame, and two or three nail kegs embellished with pink ribbons for Betty Jane, Junior and Snookums the dog.

"To pave the way for further reference to barrels, to anticipate the charming and naive questions of Betty Jane and Junior, and to put an effective stopper on the crab in the back seat, old weasel eyes himself in person constantly popping up to ask irrelevant questions, it may be advisable at this point to touch briefly on the general anatomy and construction of a wooden barrel. Fortunately the explanation is much more simple than a similar explanation in answer to—for example, the question: How old is a Chinaman, or how long is a piece of string.

"Donning for the moment the horn rimmed spectacles and rapidly riffling the leaves among the *Bs*—the bees may not like this, but, let it go—rapidly riffling the leaves among the Bs, let us see what the erudite Mr. Webster has to say on the subjects of barrels. Ah! As usual, he has plenty to say. Ahem:

"Barrel. n. (ME. barrel perh. fr. barre bar) a round bulging vessel or cask, of greater length than breadth, made of staves bound with hoops and having flat ends or heads.

"Following a reference to sizes, weights, etc., he then rambles along and touches upon barrel bolts, barrel cactus, barrel copper, barrel drain, barrel house, barrel organ, barrel process, barrel saw, and winds up appropriately enough with barrel vault.

"Thank *you*, Mr. Webster. That will be enough from you.

"In the event that you are interested—no accounting for tastes—a barrel house is described as a low drinking place. The word low refers to the character of the habitues (Colloq. bar flies) and not as might be supposed to the style of architecture or the height of the roof or ceiling. The barrel saw is a special saw employed in shaping barrel staves.

"Similarly when a man speaks of a barrel he may have in mind the contents of a barrel and not the container, the drum in a machine, the case for the main spring in a watch, the barrel of a gun, upper inside part of a bell, the case in which a piston operates, that part of a locomotive boiler containing the tubes, in anatomy the tympanum of the ear, hollow part of a feather, a windlass body, cylinder of a barrel organ, grip of a sword, or the body of a quadruped.

"A rich man is said to have barrels of money, when as a plain matter of fact his entire wealth may be represented by a sheaf of stock certificates, held in his wife's name.

"A real dyed in the wool, irreducible, blown in the bottle, nonrefillable statistical shark could select no better life time hobby than the attempt to collect and co-relate certain data and from this data to extract an estimate of the volume of matrials packed and transported in barrels in any given period. Even if by some form of miracle he had an accurate list of all the barrels in the United States, empty and loaded, afloat and ashore, including sizes and capacities in cubic inches, his conclusions still would be no more accurate than a conclusion drawn from the same data by one—the weaker one—of the famous old nursery team, the Babes in the Wood.

Height of something or other

"How come? Well, here's how come. Up to the present no human being has devised a common denominator for weight and bulk or cubical content. During its active life a barrel may serve as a receptacle for a dozen different products. The material packed in a barrel may be liquid or solid. In the first instance it is appraised, bought and sold according to liquid measure, in this country, pints, quarts and gallons. In the second instance the content of the barrel is appraised by weight in pounds.

"This custom also obtains in England. Naturally in a country where the customs have been hallowed by centuries of usage and tradition, where every man is a king in his castle and therefore opposed on general principles to everything including any attempt at standardization, we may expect to find more than the usual number of frills and offshoots, the well known exceptions to every rule. The so-called Imperial barrel in England contains 36 imperial gallons, but who's afraid of the big bad wolf, or for that matter the big bad lion? Manufacturers of various commodities market their product in any size barrel that suits their blinkin' faancy.

"In these United States the usual capacity of a barrel in liquid measure is 31½ gallons. The outstanding exception is petroleum, 42 gallongs to the barrel. Selecting a few other examples at random we find that a barrel of wheat flour, rye or corn meal weighs 196 pounds, a barrel of meat or fish contains 200 pounds. According to a United States statute of March, 1915, the standard fruit or vegetable barrel has a capacity of 105 quarts, or 7056 cubic inches. Parenthically, one is led to wonder why the capacity is specified in quarts instead of gallons. Le's see, how many gallons in 105 quarts? Oh! 26¼, eh? Well, perhaps that is the reason. If there is a reason.

"However, that theory is knocked in the head when one comes to scrutinize the capacity laid down for cranberry barrels. Believe it or not, the standard capacity of a cranberry barrel is 5826 cubic inches, or 86-45/64 quarts! If you can visualize a cranberry picker dumping 86 quarts of cranberries into a barrel and then carefully measuring 45/64 of a quart for the final addition, then all I have to say is that you have a better visualizing apparatus than I have Uncle Bim. Either that, or you never picked or packed cranberries.

"A barrel of resin, tar or pitch weighs 500 pounds, gross. That is, no cognizance is taken of any variation in the tare or weight of the container. On the other hand the piercing eagle eye of the great father in Washington prevents any rannigazoo or funny business while packing cement in barrels. A barrel of cement contains 376 pounds net, or the equivalent of four bags or sacks containing—quick, Horatio, a little rapid fire figuring here if you please—containing exactly 94 pounds each."

"Ah, cement," Bill said with the first show of animation. "Now we are getting down to something concrete, something worth while. Do you know anything about this here now new method of making molds in sand bonded with cement?"

"Why," I exclaimed in astonishment, "did you not read my recent articles on the subject in THE FOUNDRY?"

"Sure I read 'em, but I thought you were just drawing on your imagination. Is it really a fact that they are using cement?"

"'Tis," I said.

"Oh, all right. You need not ruffle up your feathers. Good night!"

STOP THIS INVASION OF DUST

Even if dust is a necessary evil in many operations it can be definitely controlled.

Blaw-Knox Dust Control is an immediate and permanent remedy for dust troubles in your industry. Each problem is met with individually designed equipment manufactured under strict technical control. Blaw-Knox Dust Control has the individualism necessary for the many and changing needs of American industry.

If your dust problem is large or small—hot or cold—dry or wet—consult Blaw-Knox for prompt and economical solution.

BLAW-KNOX COMPANY
2097 FARMERS BANK BUILDING, PITTSBURGH, PA.

BLAW-KNOX
DUST CONTROL SYSTEMS FOR INDUSTRY

Calcimine and Housekeeping

(*Continued from page* 25)

calcimine.

While each department is inspected daily by a safety man and the most glaring discrepancies in the housekeeping and safety program marked with the sprinkle of calcimine, a general and detailed inspection is held on Saturday by a safety man and the personnel director. If the plant is operating on Saturday this inspection is made on Sunday. With the plant shut down, it is possible to check every department thoroughly for any laxity in keeping tools and equipment in their proper places and the department itself free from dirt and rubbish. It is on the Saturday inspection that the yellow calcimine is used most freely.

Foremen Must Report

If the places marked with the yellow calcimine during the week or on the weekend inspection are not cleaned up within 24 hours after a safety man has so marked the particular offenses, a report is made out by the safety inspector upon his next tour of the plant and the report is sent to the superintendent. It then is necessary for the foreman to go to the superintendent's office and explain the reasons for not cleaning up the spots indicated by the safety inspector. It goes without saying that such disregard for the cleanup instructions portrayed by the yellow calcimine results in lower ratings on the daily good housekeeping chart of the department.

The foreman is charged with the responsibility of seeing that his entire department is kept clean. The greater part of this cleanup work is done by the workmen in the department at times when their particular work does not require all of their time. Certain exceptions are found, for example in the foundry proper, the gangways are cleaned at night by the cleanup gang. The overhead catwalks are cleaned every night by the same labor gang. Equipment located in several tunnels is maintained and the tunnels are cleaned by an employe from the millwright department. Regular janitors take care of toilets and wash rooms. A vacuum cleaner is employed in the core room department.

Considerable judgment must be exercised by the safety inspector in rating the various departments. For example, it is permissible that sand accumulate at certain points along the conveyor system when the plant is in operation, and therefore the existence of all such material at such times would have no bearing upon the daily rating of the department. However, the material must be removed at night, and if found around the conveyor systems or machines at the general inspection on Saturday, will count against the department and at the same time will be a spot to receive the sprinkling of yellow calcimine, which seems to have the same effect on the foremen as a red flag has when waved in front of a bull.

In arriving at the rating for a department, the safety inspector first takes into consideration the general appearance of the department, floors, equipment and tools. No rubbish can be found on the floors, such as papers, bottles, etc. Second, he determines if the material is all piled in the proper manner. Third, he checks to see if any material is out of place, and fourth, he determines if the gangways are being kept open to the designated width. The latter consideration applies not only to the foundry proper but in other departments and to the flask storage yard where all flasks are placed in piles according to size and a definite width of aisle is maintained between piles.

As previously mentioned, numerous methods are employed in selling the good housekeeping and safety campaign to the employes of the company. The first job of selling was directed at the foremen through the C.W.C. supervisors' social and educational club. That organization has regular monthly meetings with a speaker, the meetings being held in the club rooms provided by the company. The club also holds social events including a ladies' night now and then. Two safety meetings a month are held for the foremen at which both the superintendent and the safety engineer of the insurance company which holds the policy on the plant, are speakers. While the insurance safety engineer makes an inspection of the plant once a month, he also is present for the semi-monthly safety meeting of foremen.

Meetings of all employes of each department are held monthly. These meetings are devoted to educational work in both the safety and good housekeeping programs. Each foreman also is privileged to arrange for special evening parties for the men in his department, the affairs being held in the club rooms of the supervisors' social and educational club. Usually three 5-minute talks are given at these parties, one by the management, a second by the personnel director and a third by the safety inspector. The talks are interspersed with special entertainment provided from talent found among the employes of the plant. These talks usually bring up points in the housekeeping and safety work programs definitely tied into the problems of the department holding the meeting. The C.W.C. aid association supplies the lunch at these meetings. A study of this phase of the educational work shows that the great majority of men in each department wants these parties and usually suggests to the foreman that they be held.

Direct selling of safety and health is undertaken by the management through the two safety men. One safety man is the inspector previously mentioned while the second spends practically all his time in going about the plant, talking safety with each employe. The safety men will work on different shifts so that the entire plant payroll may be covered. It is estimated that the safety men succeed in talking to each employe once in about every two weeks. Their suggestions have to do with cleanliness, safety and the health of the individual.

Safety Charts Displayed

A safety chart also is displayed prominently in each department. The chart, as is shown in Fig. 9, provides a place for the posting of a gold star for each month that the department operates with no lost time accidents. The statement at the bottom of the chart, representing the attitude of the management, should act as a warning, since it states: "Mr. Foreman—Do the careless worker a favor by discharging him—We want careful workers."

If an accident takes place in any department, a yellow sheet with the notations shown at the bottom in Fig. 9 is posted over the safety chart of the department. The poster, which is called the "yellow dog" by the foremen states "This department has spoiled the plant safety record for this month by—lost time accidents." The foreman must get this poster from the superintendent and it must be acknowledged by the foreman's signature at the bottom.

The company has undertaken in many other ways to protect the health of its employes. One of the most interesting steps is the development of a "health jacket" similar in certain respects to jackets worn years ago by foundrymen. The jackets, which are all wool, protect the workman who must encounter heat and sudden cooling in connection with his duties. The jacket slips over the head, and has no buttons and is held together at the sides with an elastic band. It should be worn between the shirt and underclothes. Jackets are supplied to the men at cost, and through the educational campaign it has been possible to get the great majority of workmen to wear them.

It has been found that the jackets assist greatly in preventing pneu-

monia caused by exposure to perspiring workmen during the winter months. The company also takes considerable pains to point out to the workmen how they should dress to best protect themselves against conditions encountered.

The company maintains a store at which numerous articles can be purchased including jean jackets and jean pants which are made of wool of a design especially adapted to foundry wear. These are supplied to the employes at cost. Safety shoes must be worn throughout the foundry, and also are supplied at cost by the company. Some time ago a certain amount of difficulty was encountered by men purchasing shoes which were of a poor fit, so that now the company has employed a man with previous experience as a shoe salesman to take care of fitting the shoes. He also measures for pants and jackets.

Safety Measures Employed

Goggles and respirators must be worn by all employes of certain departments. All goggles are fitted to the man at the time he makes application for them at the safety department. Leggings are required where men handle hot metal.

The usual experience of every industry with lost time due to common colds, has led the C.W.C. company to place ammonium chloride tablets in dispensers throughout the plant. It has been found that these tablets assist in warding off colds. An enormous quantity of these tablets is used every month by the men. In the summer months, the company substitutes sodium chloride tablets as a preventative for overheating. When men work in the heat and perspiration is excessive, it has been found that these tablets supply the body with the salt which is lost through perspiration.

A first aid department and hospital are maintained at each plant with a registered nurse in charge of each first aid during the day shift, a graduate pharmacist in charge at night, and with the company doctor subject to call either day or night. Through the Aid association of the company, the doctor will administer to any employe free of charge for any ailment. Prescriptions written by the doctor are filled at the company hospital free of charge.

The first aid room and hospital are well equipped to handle any case which may arise at the plant. X-ray equipment is provided for diagnosis in the case of bone fracture. All new employes of the company are examined at the first aid room before being put to work.

The Campbell, Wyant & Cannon Foundry Co. sponsors numerous events for employes throughout the year including an open house, minstrel show, picnic, and numerous other events. The plant visitation day, held last year for the first time, has had a direct bearing upon the good housekeeping program. The plant was opened for one day for the families of the employes, with special entertainment, dancing, prizes for the children and other attractions provided by the management. Company guides were provided to conduct the visitors through the plant.

Without suggestion from the management, many of the foremen built displays illustrating the materials used and the product produced in the particular department. For example, the foreman of the core room department prepared a display as shown in Fig. 8, consisting of cores, core sand and the other necessary supplies needed to produce cores.

Several interesting things were noted in connection with the plant visitation day. Prior to the time set for the opening of the visitation program, a number of the men were found throughout the plant making last minute inspections and using white cloths to determine if any dirt remained upon the machines and other equipment. Also, some of the men reported that their wives were greatly impressed with the cleanliness of the plant. Some encountered a question from friend wife about as follows: "How do you get so dirty in the plant? I did not see any dirt there during my visit."

The annual picnic of the Campbell, Wyant & Cannon Foundry Co. has been held in recent years at Pioneer park, about 7 miles from the plant. In 1935, 7000 people were present. The company supplies the park, ice cream, coffee, lemonade, vaudeville acts, dancing, life guards for swimmers and transportation for those employes not owning cars.

Each spring the employes of the company put on a minstrel show, "Gray Iron Cast" with three performances drawing a total of approximately 3700. Attendance is limited to employes and families and the production is staged two evenings and on a Saturday afternoon so that the night crew may have the opportunity of attending. The 1936 performances were staged on Feb. 24, 25 and Saturday afternoon, Feb. 29.

Throughout the summer, two teams are entered in the regular industrial baseball league of Muskegon. One team is entered in the city soft ball league while six hard ball teams and two soft ball teams play in the shops league. The plant games are played on a diamond provided on company property. In winter, the C.W.C. all-star basketball team is entered in the Central Michigan Basketball league. The foundry team is in City Industrial league, a hockey team also is in the Industrial Hockey league, and ten bowling teams function throughout the winter months.

Chicago Studies Housekeeping Practices

Practical aspects of foundry housekeeping were discussed at the monthly meeting of the Chicago chapter of the American Foundrymen's association, Feb. 17. Speakers were E. O. Jones, director of the safety and hygiene section, American Foundrymen's association, and O. E. Mount, secretary and assistant treasurer, American Steel Foundries, Chicago, and chairman of the occupational diseases commission of the Illinois Manufacturers' association.

Mr. Jones suggested that foundries scrutinize all points where dust creation is obvious and attempt to alleviate such conditions when they exist. Attention should be given to individual molders in this respect, he stated. The practice of molders of liberal use of the air hose for cleaning purposes before and after working hours was condemned.

Dust elimination equipment and operating practice should be checked if dust settles to the capacity of the plant's roof beams in a year's time. Exhaust systems should be designed so as to be easily inspected and cleaned. It is equally important that the foundry maintain the efficiency of its dust control equipment and not permit its responsibility to end with the installation of such facilities, Mr. Jones pointed out.

Pending bills in the Illinois state legislature which will accommodate occupational disease cases were described by Mr. Mount. These bills were drawn with the co-operation of both management and labor. This legislation will provide effective protection for both employers and workers.

Annual Ladies' Night of the Chicago chapter was held at the Medinah club Feb. 14, with about 450 in attendance. The evening was devoted to dancing, cards and entertainment.

Moves Division

Welder Division of the USL Battery Corp., Niagara Falls, N. Y. has been moved to the Owen-Dyneto Corp., Syracuse, N. Y. A new line of arc welders is being designed to include many new features. J. L. Fosnight is Sales Manager of the Welder Division.

Federal specifications division, treasury department, recently has resubmitted proposed federal specification for bronze, globe, angle and cross valves for land use. The full specification has not been adopted and is subject to further revision.

TAM FOUNDRY FERRO-TITANIUM FOR CUPOLA METAL

Photo courtesy of Worthington Pump and Machinery Corporation

THE MERIT MARK OF METAL
TAM
METALLURGICAL ALLOYS

Greater

TENSILE STRENGTH... GRAIN REFINEMENT... MACHINABILITY

with 30% saving in the alloy mixtures

Truly remarkable improvements in gray iron properties are being reported thru the use of TAM Foundry Ferro-Titanium. Besides the well established deoxidizing and cleansing action of titanium, this particular TAM Alloy produces a general improvement in the more important properties of the casting. Not only is tensile strength increased, but along with this, machinability is enhanced. Another striking effect is the closing of the grain and achievement of a more uniform grain structure—especially in the heavier sections. Yet these, and other improvements are accomplished with savings up to 30% in the alloy mixtures. ★ ★ ★ May we suggest that you call in a TAM Engineer to explain the applicability of TAM Foundry Ferro-Titanium to your cupola iron? Also point out the many other TAM Metallurgical Alloys, both ferrous and non-ferrous, for increasing the quality of your products. The services of a TAM Engineer and TAM Research are available without cost or obligation. Write:

THE TITANIUM ALLOY MANUFACTURING CO.

Ti Zr Mo PRODUCTS

GENERAL OFFICES AND WORKS: NIAGARA FALLS, N. Y., U. S. A. EXECUTIVE OFFICES: 111 BROADWAY, NEW YORK CITY

REPRESENTATIVES FOR THE PACIFIC COAST . . . . BALFOUR, GUTHRIE & CO., San Francisco, Los Angeles, Portland, Seattle, Tacoma

REPRESENTATIVES FOR CANADA . . RAILWAY & POWER ENG. CORP., LTD., Toronto, Montreal, Hamilton, Winnipeg, Vancouver, Sydney

REPRESENTATIVES FOR EUROPE . . . . . T. ROWLANDS & CO., LTD., 23-27, Broomhall St., Sheffield, England

Melts Scrap in Brass Foundry

(*Concluded from page 27*)

engaged in the production of large numbers of duplicate castings. In this instance the split metal corebox has cavities for four cores. With the two valves in front of him on the bench, face up, the coremaker fills the cavities with sand, packs it down by hand, scrapes the surface off flat, stamps a vent channel in one half, brings both halves face to face in a vertical position, lays the corebox flat on the cope side, removes the upper half, sets a dryer shell in place, reverses half box and dryer shell, removes half core box and repeats the operation indefinitely. The dryer shells support the cores while in the green state, and prevent them from sagging or becoming otherwise distorted during the baking period in the oven.

Use Oil Bond

Cores are composed of sharp sand bonded with oil. In some instances a small amount of bank sand is added to the mixture to assist the cores in holding their shape while green. Molding sand reduces the permeability and therefore cannot be added to cores in which the free and practically instantaneous escape of the gas is obligatory. This is a feature which can be determined only by actual experience. The cores are dried in a small shelf type oven heated with gas.

Furnaces for melting the metal are located in a building near one end and outside the foundry proper. In the battery of 7 furnaces, set flush with the floor close to one wall as shown in Fig. 1, two are fired with gas, while the remaining five are fired with oil. Each pot holds about 200 pounds of metal and the average number of heats per day for the entire battery is 24, or 4800 pounds. The pot is the standard size listed as No. 70. Crucibles are listed by the manufacturers according to an arbitrary scale of numbers. The numbers correspond to the holding capacity in pounds in the ratio of 1 to 3. For example the holding capacity of a No. 70 crucible is 210 pounds, a No. 80, 240 pounds and so on, either up or down the scale of numbers.

Metal for making up the various charges is stored in a series of bins on the opposite side of the room from the furnaces. Each bin is numbered and contains only material of approximately similar composition. In contrast to the dim and eerie caverns in which the old time melter compounded and melted his mixtures, this clean, tidy, brick floored furnace room is flooded with light from large windows in the walls and roof. Instead of depending on the sense of touch, the melter can exercise the sense of sight in addition to the mysterious sixth sense exercised by all expert melters in the selection of material for any given charge. An accurate scale on which all the material is weighed is considered an asset in making up individual charges, and in maintaining a record of metal in and metal out of the furnace room.

One man attends to all activities incidental to melting the metal. He places the empty crucibles in the furnaces, charges them according to the day's schedule and lifts them out. A second man and a helper transfer the crucibles to the foundry and pour the metal into the molds. The crucibles are not carried in the usual manner, that is in double end shanks. Instead of a shank, the crucible is held in a pair of tongs provided at the bottom and center with close fitting lateral prongs, and closer to the top with a pair of trunnions on opposite sides. These trunnions are engaged by a light bail suspended from a monorail. One branch of the monorail extends over the center from end to end of the furnace room and projects into the foundry a sufficient distance at a right angle to connect through a switch with a second main branch extending above the gangway from one end of the foundry to the other end. Individual branches at right angles to the main line extend over each floor.

Pouring the Metal

Method of pouring the metal is shown in Fig. 2, where the attendant tips the crucible by pulling forward on the upper end of the tongs with one hand, while he manipulates a skimmer with the other hand. The second man operates a light chain hoist by which the crucible is hoisted or lowered according to requirements.

An efficient device for lifting the pot out of the furnace is shown in Fig. 1. A short double chain with a large center link is connected permanently close to the upper end of the tongs. This chain is engaged by one end of a 10-foot length of 3-inch steel pipe. The pipe is suspended at a point about 2 feet from the end, thus providing the operator with a powerful lever for lifting the pot with a minimum of effort. Pressure on the short chain automatically pulls the two upper ends of the tongs together and this in turn causes the lower ends of the tongs to grip the crucible tightly. The long pipe lever is suspended from the monorail beam and readily may be into position over any of the furnaces.

Composition of Typical Brass and Bronze Mixtures

Name of Alloy	Aluminum	Antimony	Copper	Iron	Lead	Manganese	Phosphorus	Tin	Zinc
Brass, cheap red	.....	.....	(Scrap) 40	....	7.50	†(Machinery scrap 45)	.....	.....	7.50
Brass, cheap yellow	.....	.....	60	....	4	.....	.....	.....	36
Brass, red	.....	.....	82-87	....	8	.....	.....	2 to 3	2 to 8
Brass, plumber's	.....	.....	(Scrap) 25	....	2	‡(Remainder sheet scrap)	.....	1	.....
Brass, tough	.....	.....	84.50	....	3	.....	.....	2.50	10
Brass, U. S. Navy	.....	.....	59-63	0.06	0.60	.....	.....	0.5 to 1.5	35.5 to 40.5
Brass, white	.....	1.5	2.25	....	....	§(Phos. tin 2)	.....	55.50	38.75
Brass, yellow	.....	.....	70	....	2	.....	.....	2.5	25.5
Bronze, acid resisting	.....	3.75	72	....	20	.....	0.45	1.25	.....
Bronze, aluminum	10	.....	88.90	1	.....	.....	0.10	.....	.....
Bronze, cheap	.....	.....	66.5	....	2	¶(Remainder brass scrap)	.....	4	2.5
Bronze, machinery	.....	.....	88.5	....	2.5	.....	.....	5.5	3.5
Bronze, Tobin	.....	.....	59	0.10	0.30	.....	.....	2.20	38.40
Bronze, valves	.....	.....	87	0.06	1	.....	.....	7	6
Gun metal	.....	.....	86.5	....	....	.....	0.5	11.75	1.75
Manganese bronze (imitation)	0.5	.....	59	0.5	....	.....	.....	0.5	40
Manganese bronze (Navy)	1.25	.....	56	1.75	....	(80% ferro-manganese, 4)	.....	.....	37
Manganese Bronze, Parsons	0.4	.....	57.10	1.20	....	0.10	.....	0.70	40.50
Manganese Bronze, U. S.	0.5	.....	57-60	1.00	....	0.30	.....	0.75	37 to 40
Monel metal	0.5	.....	33	6.5		(Nickel 60 minimum)	.....	.....	.....
Muntz metal	.....	.....	60	....	....	.....	.....	.....	40
Phosphor bronze	.....	.....	90	....	....	.....	0.75	5	.....
Phosphor bronze bearing	.....	.....	81	....	9	.....	0.45	7	.....
Statuary	.....	.....	90	....	....	.....	.....	7	3
Tablets—1	.....	.....	90	....	....	.....	.....	2.5	7.5
Tablets—2	.....	.....	88	....	2.5	.....	.....	6	3.5
Tablets—3	.....	.....	79	....	....	.....	.....	1	20

Bonds Steel Molds with Cement

(*Continued from page* 32)

sylvania almost from the days of William Penn.

In 1733 young William Bird recently from England was cutting wood for use at Thomas Rutter's Pine Forge for 2 shillings and 9 pence per day. Ten years later he was renting one-eighth of Pine Forge at 40 pounds per year. William Bird for whom the borough of Birdsboro is named, built this first forge adjacent to land originaaly purchased by Caleb Harrison from John, Thomas and Richard Penn. The deed conveying the property gives

Fig. 11—Cement bonded sand is used in large valve cores

"Said Caleb Harrison, his heirs and assigns free leave, right and liberty to hawk, hunt, fish and fowl in and up on the hereby granted lands and premises." Further: "Harrison was to be beholden of us our heirs and successors, proprietaries of Pennsylvania, as of the manor of Conestogoe in the county of Lancaster in free and common soccage by fealty only in lieu of all other services yielding and paying, therefore, yearly to us, our heirs and successors at the town of Lancaster upon the first day of March in each year one half penny Sterling for every acre of the same."

When William Bird died in 1761 operation of his various properties, holdings and industrial enterprises were taken over by his son Mark Bird and by his widow who afterward married the iron master John Patton. The list included lots in Reading, large tracts of land near Reading, two messuages, one water corn mill and 597 acres in Amity township; three messuages, three forges, one grist mill, one saw mill and 2401 acres in Union and Robeson townships, one messuage, one iron furnace and 2000 acres in Heidelberg township. Soon after inheriting the forges, houses and land near Birdsboro, Mark Bird built the Hopewell furnace in 1770. In the stack of the old stone furnace which still is standing one corner stone bears the date 1770 and a second stone bears the date 1771.

At Birdsboro about the time of the Revolution, he built a rolling mill, a slitting mill and a nail factory, probably the first in the country. He built Spring forge in Oley township and the Gibraltar forges in Robeson. At Trenton, N. J., he manufactured wire. He increased his land holdings to over 8500 acres.

In August 1776 Colonel Mark Bird fitted out 300 of his men with uniforms, tents and provisions at his own expense. He went to the relief of Washington soon after the battle of Brandywine. At his furnaces he cast cannon and ammunition for the continental army.

Suffers from Depression

As with many other patriots, Colonel Bird became financially embarassed in the depression following the panic of 1783. He suffered, according to old records, from fire and flood. He had supplied the Revolutionary army with arms and ammunition and doubtless had loaned money to the Colonial cause for which he was not repaid. His iron operations were large and extended for those days. The paper dollar of the Continental government in which his earlier debts probably had been paid was so depreciated that one gold dollar in 1786 was worth 5000 continental paper dollars.

As a result of these conditions in 1786 he made an assignment of all his property to John Nixon, a wealthy Philadelphia merchant from whom he had borrowed 200,000 Spanish milled dollars. Two years later he died in North Carolina.

In 1800 Hopewell furnace and the large acreage of woodland belonging to Hopewell was purchased by Matthew Brooke, Thomas Brooke and their brother-in-law Daniel Buckley. After Captain Barde's death in 1799 his widow Anne Farmer Barde and her brother Robert A. Farmer as administrators continued the operation of the forges for several years or until 1809 when Matthew Brooke who had married Captain Barde's daughter Elizabeth, in 1805, bought the Barde holdings, and continued in active management until his death in 1821. During his children's minority the works were rented until 1837 when the management was taken over by his sons Edward and George under the firm name E. & G. Brooke. Total production of iron per year at that time was about 200 tons. The new firm immediately began expanding. In 1846 Hampton furnace was built on the site of the old forge of that name, originally built in 1759. A rolling mill and nail factory were added in 1848. Eighteen nail making machines were driven by water power. Later the mill was enlarged to operate 120 nail machines driven by steam power and capable of producing 250,000 to 300,000 kegs of nails per year. The firm built a blast furnace in 1852, another in 1871 and a third in 1873. With the old Hampton charcoal stack the firm had four stacks in operation. In 1880 the firm of E. & G. Brooke was incorporated under the name of E. & G. Brooke Iron Co.

Fig. 12—Front and back views of 72-inch bronze stern sleeve bushing

Gradually as the efficiency of new stacks increased, the older stacks were torn down and dismantled. Thus in 1898 the capacity of the two existing stacks was 75,000 tons of iron per year. One was dismantled in 1916 and the other rebuilt to its present capacity of 140,000 tons per year.

The Birdsboro Iron Foundry Co., originally a joint stock association, began with a small foundry in 1867. In 1894 the company was taken over by the Brooke interests which continues to the present as chief owners. The name was changed to Birdsboro Steel Foundry & Machine Co., in 1906. Additions and improvements over a period of years have culminated in the present large plant with a monthly capacity of 2500 tons of steel castings, also a roll foundry and large machine and erection shops. The Brooke family name is perpetuated in ownership and management by Robert E. Brooke, chairman of the board of directors, and by George Brooke, III, treasurer.

The old Hopewell blast furnace water wheel and blowing tubs as they appeared a few years ago are

shown in Fig 1. Recently the blowing equipment was dismantled for removal to the Franklin institute, Philadelphia, to be re-erected as an interesting example of the pioneering exploits of the early American iron masters, and a sterling testimonial of the skill and handicraft of the honest old masons, blacksmiths, millwrights and joiners who fashioned the equipment under primitive conditions and with a pitifully limited number and variety of hand tools.

This is the fourth and concluding article in a series dealing with cement-sand molds for steel castings. The first appeared in the December, 1935 issue.

The Editors

Considers Carbon in Pig Iron At Annual Convention of A. I. M. E.

THE largest attendance in several years was present at the 145th meeting of the American Institute of Mining and Metallurgical Engineers in New York, Feb. 17-21. More than 1700 registered for the various sessions, which contributed much discussion of interest to the general field of metallurgy, but which probably offered less than usual of special concern to the foundry industry. A feature of the Steel and Institute of Metals divisions was a joint symposium on the use of metals in modern transportation.

John M. Lovejoy, president of the Seaboard Oil Co., New York, was elected president of the institute, to succeed Dr. Henry A. Buehler, state geologist and director of the Missouri bureau of geology and mines. Roland C. Allen, vice president of Oglebay, Norton & Co., Cleveland, and Henry Krumb, consulting mining engineer, were named vice presidents.

Correlation Is Discussed

Five directors, some for second terms, were chosen as follows:

Eli T. Conner, coal mining engineer, Scranton, Pa.; John L. Christie, metallurgist, Bridgeport, Conn.; Selwyn G. Blaylock, vice president of the Consolidated Mining & Smelting Co., Trail, B. C., Canada; Frank L. Sizer, mining engineer, San Francisco, and William B. Heroy, oil geologist, New York. Mr. Heroy is president of the American Petroleum institute.

The Howe lecture was, as usual, a feature. It was presented by H. F. Moore, research professor of engineering materials, University of Illinois, Champaign, Ill., on the subject of "Correlation of Metallography and Mechanical Tests of Metals."

Discussing first the need of correlation, Professor Moore then briefly treated the underlying theory of mechanical testing and that of metallography, fixing the limitations of each branch of the study noted. He placed emphasis on mechanical testing on quantitative results, suitable as bases for specifications, and in metallography on qualitative results.

Fields in which correlative studies seem highly desirable include: The mechanism of creep and of fracture in metals. The question as to when a fatigue crack starts is still unanswered, the speaker said. The problem of the mechanism of aging in metals, of the resisting strength of the grain boundaries compared with the intra-crystalline metal, and of the damaging effect of internal strains in metals, compared with that of strains or stresses caused by external loads and moments are problems on which much more light is needed and which will require correlation of metallographic and mechanical test.

Special interest was focused on a paper entitled "Carbon in Pig Iron", by William E. Brewster, superintendent of blast furnaces, Wisconsin Steel Works, International Harvester Co., Chicago. The author declared that much more work was to be done in further substantiating the ideas and data contained, adding that the conclusions were presented at this time in the hope that they would stimulate constructive criticism and further work which "may definitely change the present-day conception that nothing can be done in blast furnace practice to control carbon content in pig iron."

Prefacing his remarks, Mr. Brewster said that 5 years ago various foundries had made inquiries of his company as to the probable total carbon content in a given specification in grade of pig iron. It was then that his company first began to accumulate data which led to the conclusions and questions presented in the paper. They sampled all piles of all grades of pig iron, except basic, making complete analyses. Finding some variation in carbon content, more samples were secured and the carbon content with respect to silicon was plotted in each grade of iron except for the higher phosphorus foundry iron where it was necessary to divide the group into 20 point phosphorus ranges. He described the method pursued adding that by means of the graphs prepared they were able to answer inquiries as to the total carbon content of a given grade fairly satisfactorily.

About a year ago the company blew in a new furnace, a furnace equipped with modern hot blast stoves with ample capacity for high heats, automative hot gas control, automatically controlled filling, and a rotary double screw type mud gun, capable of stopping the iron notch with no slackening of the blast whatsoever, thus making for continuous blast operation. They then resumed their study of the carbon content in pig iron so as to bring the iron produced in the new furnace into their calculations. They were prompted, Mr. Brewster said, to do this primarily, because of an apparently higher temperature of the iron tapped.

After securing a large number of determinations, 916 in all, they again plotted to the total carbon curves on various grades of iron. These curves were plotted against the curves previously derived from iron of their other furnaces, and they found, after examining these curves, that the iron made in the new furnace exhibited a trend of 0.10 to 0.25 per cent higher total carbon than had been the case heretofore.

The speaker described various comparisons and data compiled, pointing out that his company has been confronted with the problem of reconciling higher total carbon content in pig iron produced on the new furnace, as compared with previous determinations on their other furnaces, using the same coke, limestone and ores. There were but two outstanding differences between the operation of the new furnace and the others; namely, higher blast heats and more continuous application of blast.

In one chart he showed that a variation in blast temperature alone, from 1100 to 1500 degrees Fahr., fails to influence the total carbon content. He indicated that the new furnace was consistent in gasifying less carbon at the tuyeres than was necessary for the indirect reduction of Fe from Fe_2O_3 in the charge, and that this was not generally the case in other furnace practice on lower blast temperatures.

In plotting the new curves against those previously derived prior to the blowing in of the new furnace, they found in one graph, having to do with malleable, that both curves met at about 0.70 per cent silicon, and become more and more divergent as they increased the silicon content. In three other charts, pertaining to foundry iron and showing various phosphorus changes, the comparison was not as uniform nor as regular as was the case with respect to the malleable iron.

EXPERIENCE COUNTS

. . . . . HERE GUESS WORK PLAYS NO PART

Experience—computed in terms of efficient operation and low maintenance cost—and multiplied by hundreds of installations, where the record of Bartlett-Snow equipment has been gratifying alike to the purchasers and ourselves—*is at your disposal.*

Nor is this important asset limited to certain fields . . . confined to prescribed conditions. In brass, aluminum, steel, malleable and gray iron foundries for more than 20 years the words "Bartlett-Snow" have been synonymous with "Proven in Service."

Small wonder that officials of large and small, of jobbing and production foundries, turn to Bartlett-Snow for their equipment. Follow their example. Then, you too, will secure the advice of experts, whose wide familiarity with practical, rather than theoretical problems, has enabled scores of companies to enter new fields of efficient low cost operation.

THE C. O. BARTLETT & SNOW CO.

6201 Harvard Avenue **Cleveland, Ohio**

In New York—
30 Church Street

In Chicago—
First National Bank Building

In Europe—
Georges Fischer Stahlwerke, Schaffhousen, Switzerland

BARTLETT-SNOW

foundry Equipment

Shakeouts • Aerators • Pug Mills • Mullers • Mixers
Hoppers • Mold Conveyors • Core Ovens • Air Filters

Gray Cast Iron (*Chapter VI Continued*)

(*Continued from page* 35)

4.5; and crystal lattice, hexagonal close packed.

Some pig irons contain appreciable percentages of titanium. Most of this is lost in cupola melting. Ladle additions may result in retention of 50 per cent or less of added titanium. Titanium in amounts up to 0.1 per cent has a decided graphitizing action but beyond that point it apparently has little effect on graphitization. When retained titanium amounted to about 0.50 per cent in a 1 per cent silicon mottled iron or 0.35 per cent in a 2.75 per cent silicon gray iron, an increase of about 50 per cent in transverse strength was noted in Piwowarsky's experiments. The mottled iron (1.63 combined carbon) was converted into a gray iron with 0.98 combined carbon. The original 0.57 per cent combined carbon of a gray iron was reduced to 0.41 per cent combined carbon.

Titanium has a marked degasifying effect, as has been shown by researches on its effect in steels. It is claimed that it has a refining action on graphite flakes. Corrosion resistance is said to be increased.

Comstock states that titanium additions are made most advantageously to irons containing carbide forming elements like chromium. Under such conditions considerable increases in strength and hardness may be attained with no loss in machinability.

References

1—Moldenke — *Transactions*, American Foundrymen's Association, 1908.
2—Trueheit—*Stahl und Eisen*, Vol. 30, pages 1192-1201, 1910.
3—Stoughton—*Bulletin*, American Institute Mining Engineers, Vol. 71, pages 1245-1275, 1912.
4—Piwowarsky—*Stahl und Eisen*, Vol. 43, pages 1491-1494, 1923.
5—Piwowarsky—*Stahl und Eisen*, Vol. 44, page 745, June 26, 1924.
6—Kuster and Pfannenschmidt—*Die Giesserei*—No. 3, 1931.
7—Challonset—*Comptes Rendus*, Vol. 194, pages 283-285, Jan. 18, 1932.
8—Comstock — *Transactions*, American Foundrymen's Association, Vol. 5, pages 278-287, 1934.

Effect of Tungsten

TUNGSTEN has the following properties: Atomic weight 184.0; melting point 6150 degrees Fahr.; density 19.3; and crystal lattice—body centered cubic.

The principal sources of tungsten in foundry melting stock are high speed steel and chrome tungsten steel. Tungsten is not lost in cupola melting.

Tungsten is essentially a carbide stabilizer, although, from the meager evidence available, it is not as effective in that respect as chromium. The carbide of tungsten (a component of high speed steels and the major component of the tungsten carbide cutting tools) is extremely hard and if present in appreciable amounts in cast iron would be highly detrimental to machinability. Tungsten lowers the carbon percentage for the eutectoid about 0.1 per cent for 2 per cent tungsten—being in this respect about as effective as nickel.

According to Campion, additions under 1 per cent show little influence on the properties, but from 1 per cent to 2 per cent there is considerable increase in strength, and the carbide is relatively stable at elevated temperature. However, Piwowarsky showed that up to 0.5 per cent the tungsten was found in the ferrite and exerted a favorable influence on all the mechanical properties.

References

1—Campion—*Proceedings*, British Foundrymen's Association, page 81, 1917-1918.
2—Smalley—*Foundry Trade Journal*, Dec. 31, 1922 and Jan. 4, 1923.
3—Donaldson—*Journal* West Scotland Iron and Steel Institute, Vol. 31, pages 54-62, 1924.
4—Piwowarsky—*Stahl und Eisen*, Vol. 45, pages 289-297, Feb. 26, 1925.
5—Takeda—*Technical Reports*—Tohoku Imperial University, Vol. 9, pages 447-461, November, 1930.

Effect of Uranium

THE properties of uranium are as follows: Atomic weight 238.2; melting point 3362 degrees Fahr.; and density 18.7.

Additions up to 0.2 per cent apparently have little effect, whereas additions up to 0.5 per cent increased strength slightly.

References

1—Smalley—*Engineering*, Vol. 114, pages 277-280, 1922.
2—Foote—THE FOUNDRY—page 105, Feb. 1, 1924.

Effect of Vanadium

VANADIUM has the following properties: Atomic weight 51.0; melting point 3128 degrees Fahr.; density 6.0; and crystal lattice, body centered cubic.

Small percentages of vanadium are found in various alloy steels. Most of the vanadium is retained during cupola melting.

Vanadium has a carbide stabilizing influence. It is found in both the carbide and ferrite phases, and hardens both phases. The carbide V_4C_3 is very hard. Vanadium reduces the percentage of combined carbon required for a pearlitic matrix rather rapidly, 1 per cent vanadium lowering it about 0.2 per cent. Small additions of vanadium improve the mechanical properties of cast iron. Additions of 0.5 to 1.0 per cent in irons under 2 per cent silicon increase the strength markedly, with increase in brinell hardness from 170 to 250. Vanadium displaces the eutectoid transformation temperature slightly.

References

1—Moldenke — *Transactions*, American Foundrymen's Association, 1907.
2—Smith—THE FOUNDRY, February, 1909.

(*Concluded on page* 77)

Table VIII

Influence of Additions of Tin to Cast Iron

Sample	CC	Gr	Si	Mn	S	P	Tot. C	Sn	Normal hardness	Temp. at which hardness commences to fall off, degrees Cent.	Hardness at 800 degrees Cent.	Hardness after heat treatment
1	0.48	2.80	1.6	1.2	0.05	0.13	3.28	Nil	196-228	600	48	207-228*
2	.....	.....	0.42	0.99	0.123	0.112	2.96	Nil	387-477	500	95	430-512†
3	0.60	2.70	1.46	1.10	0.04	0.15	3.3	0.28	207-288	500	68	223-225
4	0.90	2.60	1.55	1.37	0.06	0.14	3.5	1.07	228-302	500	72	262-321
5	0.90	2.40	1.36	1.27	0.05	0.10	3.3	1.94	418-555	500	68	418-455
6	0.70	2.20	1.27	1.21	0.04	0.14	2.9	4.64	444-600	500	126	495-600
7	.....	.....	0.28	0.94	0.11	0.14	2.6	0.54	321-364	500-600	163	364-444‡
8	.....	.....	0.37	1.05	0.10	0.08	2.4	0.88	302-364	500	116	364-444‡

*Ordinary sand cast.
†Chill cast steel mixture, 25 per cent steel.
‡Steel mixture containing tin.

ADVERTISING PAGES REMOVED

(*Concluded from page 74*)

3—Norris—New England Foundrymen's Association, May, 1910.
4—Hatfield—*Journal*, Iron and Steel Institute, Vol. 1, 1911.
5—Fitch—*Iron Trade Review*, pages 72-74, July 9, 1918.
6—Smalley—*Engineering*, Vol. 114, pages 277-280, 1922.
7—Piwowarsky—*Stahl und Eisen*, pages 289-297, Feb. 6, 1925.
8—Challonset—*Revue de Metallurgie*, Vol. 27, pages 573-603, November, 1930.
9—Wever and Jellinghaus—*Stahl und Eisen*, Vol. 50, page 1788, December, 1930.
10—Oya—*Kinzoku no Kenkyu*—pages 615-634, November, 1930.
11—Vogel and Martin—*Archiv fur Eisenhuttenwesen*, Vol. 4, pages 487-495, April, 1931.
12—Reed—*Transactions*, American Society of Steel Treating, Vol. 20, No. 2, pages 146-149, 1932.

Effect of Zinc

ZINC has the following properties: Atomic weight 65.37; melting point 788 degrees Fahr.; density 7.14; and crystal lattice—hexagonal close packed.

Due to the fact that zinc volatilizes readily and oxidizes with ease it is unlikely that it can be introduced into cast iron in appreciable percentages. However, in presence of copper and other alloys some zinc may be retained. Under such conditions zinc lowers the transverse strength and impact resistance markedly, at the same time increasing the hardness and rigidity. Amounts over 0.02 per cent in austenitic cast irons are especially detrimental to impact strength.

References

1—Williams, Sims and Newhall — THE FOUNDRY, page 5, Jan. 1, 1924.
2—Smith and Riggan—*Transactions*, American Foundrymen's Association, page 51, 1929.
3—Spencer and Walding — *Transactions*, American Foundrymen's Association, page 507, Vol. 4, 1932.

Effect of Zirconium

PROPERTIES of zirconium are as follows: Atomic weight 90.6; melting point 3375 degrees Fahr. (Zeikker and DeBoer); density 6.4; and crystal lattice, hexagonal close packed.

Zirconium has been added to cast iron as a deoxidizing element. Although added zirconium is lost, it appears to strengthen and toughen cast iron somewhat due to its deoxidizing power.

References

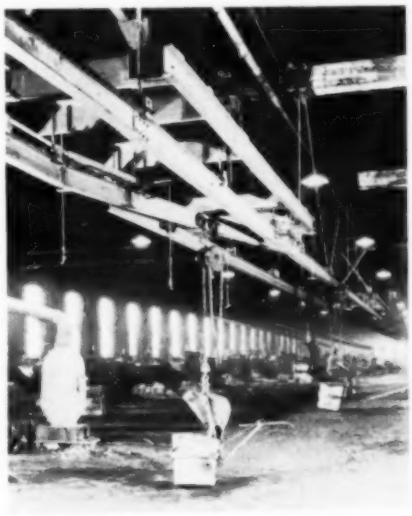
1—Moldenke — *Transactions*, American Foundrymen's Association, Vol. 29, page 391, 1920.
2—Smalley—*Engineering*, Vol. 114, pages 277-280, 1922.
3—Vogel and Tonn—*Archiv fur Eisenhuttenwesen*, Vol. 5, pages 387-389, January, 1932.
4—Hall—THE FOUNDRY—pages 22, 23, 54, April, 1934.

To Make Chaplets

Cambridge Hinge Tube & Chaplet Works Inc., Cambridge, N. Y., has been organized recently to manufacture hinge tubes and chaplets. Walter E. LeGrys is secretary.

Trolley System In Malleable Iron Shop

Changing over from a group of air furnaces to a continuous melting unit made up of a cupola and single air furnace at the plant of the Eberhard Mfg. Co., Cleveland, included the installation of a monorail trolley system for the distribution of the molten metal. The shape of the foundry building may be compared to that of a huge *T* with the upper or horizontal member 600 feet in length, and the upright member 400 feet in length. Thus the entire length of the monorail system which extends to the ends in both branches of the building is approximately 1000 feet.



Metal is carried from the air furnace to molding floor over a conveyor system

The air furnace from which the metal is removed for distribution is located close to the right angle of the junction of both members of the trolley system. This is an approximately central point. The extreme distance to which metal has to be carried right or left from the furnace is about 300 feet. In the bay represented by the stem of the *T*, the distance is about 400 feet.

The double rail system suspended approximately 10 feet above the floor was designed and installed by the Cleveland Chain Co., Cleveland. It is provided with a loop at each extremity, and with two loops in the vicinity of the furnace. In addition 11 switches facilitate movement of the filled and empty ladles in either direction. The switches are operated by short pendant chains within easy reach of the operators.

The number of industrial workers killed last year, 16,500, was less than half the number of deaths in occupational accidents 25 years ago. The National Safety council estimates that during the years of organized industrial safety work, from 1913 to 1935, the lives of about 250,000 workers have been saved.

Core Problems Feature Boston Meeting

Leroy P. Robinson, director of core oil sales, Werner G. Smith Co., Cleveland, gave the principal address at the regular meeting of the New England Foundrymen's association, held on Feb. 12, at the Engineers club, Boston. His subject was "Some Common Sources of Core Room Trouble."

The speaker stated that the requisite of good core oil is that of making good cores as cheaply as possible. For a good core to function at its best, it is necessary to provide good sands, right moisture content for the sands, correct temperature control of the core oven, correct humidity of the core oven, correct venting of the cores, correct core oil ratio, and correct inspection of the cores.

Mr. Robinson spoke about the nonuniform practices in relation to many of the conditions previously mentioned, emphasizing in particular the prevalence of over and under baking and the inaccurate temperature control, as well as the attempt to get along with inferior sands, with moisture content and core oil ratio unknown or at least inaccurate. He has been affiliated with core rooms of America for the past twenty years and related many interesting experiences.

The N. E. F. A. is considering the advisability of forming a chapter of the American Foundrymen's association, and a committee has been appointed to investigate factors involved in that affiliation.

Shop Employes School

About 75 United Engineering & Foundry Co., Youngstown, O., shop employes, ranging from laborers to machinists, have been enrolled in special shop mathematics and mechanical drawing courses in Youngstown College, Youngstown, O. Ernest E. Tross, general superintendent of the company, plans a similar mechanical engineering course next fall, with those enrolled spending one month in the plant and one month in the school.

District Office Moved

H. Kramer & Co., Chicago, brass and aluminum ingot manufacturer, has moved its Cleveland district offices from 422 to 740 Leader building, Cleveland. Sol M. Marks is representative for the company.

Proper Gate Delivers Clean Metal

(*Continued from page* 34)

stream. The mold and gates are relieved from that extra force. No relief gate or sprue is necessary. A funnel shape cannot do this work as effectively and is difficult to keep filled. It also is good practice to keep the ladle lip as near as possible to the pouring basin. No dirt has a chance to flow down the sprue while the cup is kept filled to its proper level.

The sprue should be round, straight and large enough to provide a sufficient rate of flow to fill the mold properly. A tapered sprue has a nozzling effect, which is not desirable at the junction with the runner. If only the cup and proper sprue are used, fairly good results will be obtained.

All runners should be placed or cut deeply in the cope. There is no exception to this rule. This feature alone would prevent a good deal of dirt in castings. Good cross sectional examples of runners are illustrated at *A*, *B* and *C*, Fig. 2.

It is possible for dirt particles to get down the sprue while the cup first is being filled. Dirt may free itself from the wall of the sprue or runner. Provisions should be made to arrest these particles before they enter the mold. If the runner is in the cope and high, all this dirt will have a good chance to rise to the top where it will be trapped and will remain there as long as the runner is kept full. Regardless of their size, if the runners are in the drag, those particles of dirt again will rise to the top, but will flow into the mold. The shallow runner *E*, Fig. 2, may prevent dirt from entering the mold, but it will not be as effective as runners *A*, *B* and *C*.

Gate Design Important

One objection to the cope runner is the inconvenience of cutting it, especially among gaggers. This objection wears off in a short time. Position of the runner always is determined in advance and the gaggers are placed where they will not interfere. The runner in the cope may be cleaned with the air hose at the same time the molder blows the joint without danger of blowing dirt into it, as he might where the runner is cut in the drag after the pattern is drawn.

For straight runners, any stick of a desired cross sectional shape may be used. On irregular shaped runners where the job is to be repeated, the first runner is made with extra care. After the casting is poured, the runner is removed, cleaned, ground slightly and used as a pattern or set gate.

Branch gates must not be slighted. Wherever possible they should be horizontal, flat, thin and numerous. They must not nozzle into the mold cavity, a characteristic of many gates one finds on gated patterns. Consider an ordinary hose with water flowing through it. Squeeze the outlet end, thereby decreasing the cross sectional area of the outlet and mark the increase of force in the stream. Obviously the latter stream is more destructive than the first.

The same thing happens at the entrance to a mold if the gate is choked there. Metal enters the mold with increased velocity. If the sand is unable to withstand this increased force, the result will be a dirty casting.

Consider the same hose with the same stream of water and assume that it is squeezed a little further back of the outlet. A decrease in force of the stream will be observed. Molten metal follows the same law and gates should be designed accordingly. The general trend in branch gate design should be reversed. Branch gates should have a smaller cross sectional area nearer the runner than the pattern. This is shown in Fig. 3 where cross sectional area FF′ near the runner is smaller than cross sectional area GG′ near the mold entrance.

Branch gates of this design easily and readily are cut with an ordinary gate cutter, and also are adaptable to matchplates. In the latter case it may be to some advantage to place the branch gate in the cope when possible. This would give a good, flat bottom to the runners where the stream of iron would not meet any obstruction. If the branch gates are placed in the drag, care should be taken to have no sharp or weak corners that would obstruct the flow of metal, with the risk of being washed into the mold.

On gated patterns it would be difficult to adhere strictly to this design as the placing of the smaller area at the runner would weaken the pattern structure if the usual method of pattern attachment to runner is used. Possibly a better method could be used where rigidity would not be sacrificed materially with the use of proper gate design. If the old method cannot be changed efficiently, then the best thing to do is to make sure that the sprue cross sectional area is slightly greater than the sum of all cross sectional gate areas taken at the smallest or choke area.

In most cases the gates should be numerous to provide better distribution of the metal and not have the flow concentrated at one spot, especially if the metal has to flow over a green sand surface. Gates should be thin to better assist the runner in trapping the dirt. Vertical gates cannot do as well as horizontal gates. This is shown in Fig. 5, where if any dirt gets in the bottom of the vertical gate *X*, before the whole gate system is filled, it will have the long distance *Q* to rise before it can be trapped in the runner. Most likely before this can happen, the dirt has been carried into the mold. In the horizontal gate *Z*, the distance *q* is much less and the chance of any particles of dirt being trapped in this instance is directly proportional to the difference in the height of *Q* and *q*.

The pouring sprue *d* never should be placed directly over the junction of a branch gate as in Fig. 6. The downward force of the metal should be broken before it enters the mold. Further if it was so placed, the one particular gate at the junction would take more than its share of the metal and the mold would suffer at that point. The sprues should be arranged as shown in Fig. 3.

Total cross sectional area of the branch gates taken near the runner at FF′ and XX′ as in Fig. 7 should not be greater than the cross sectional area of sprue *d*. If the cross sectional area of the branch gates was much greater than the cross sectional sprue area, the metal in the runner would be low and any dirt in the stream would be carried into the mold.

Would Tear the Mold

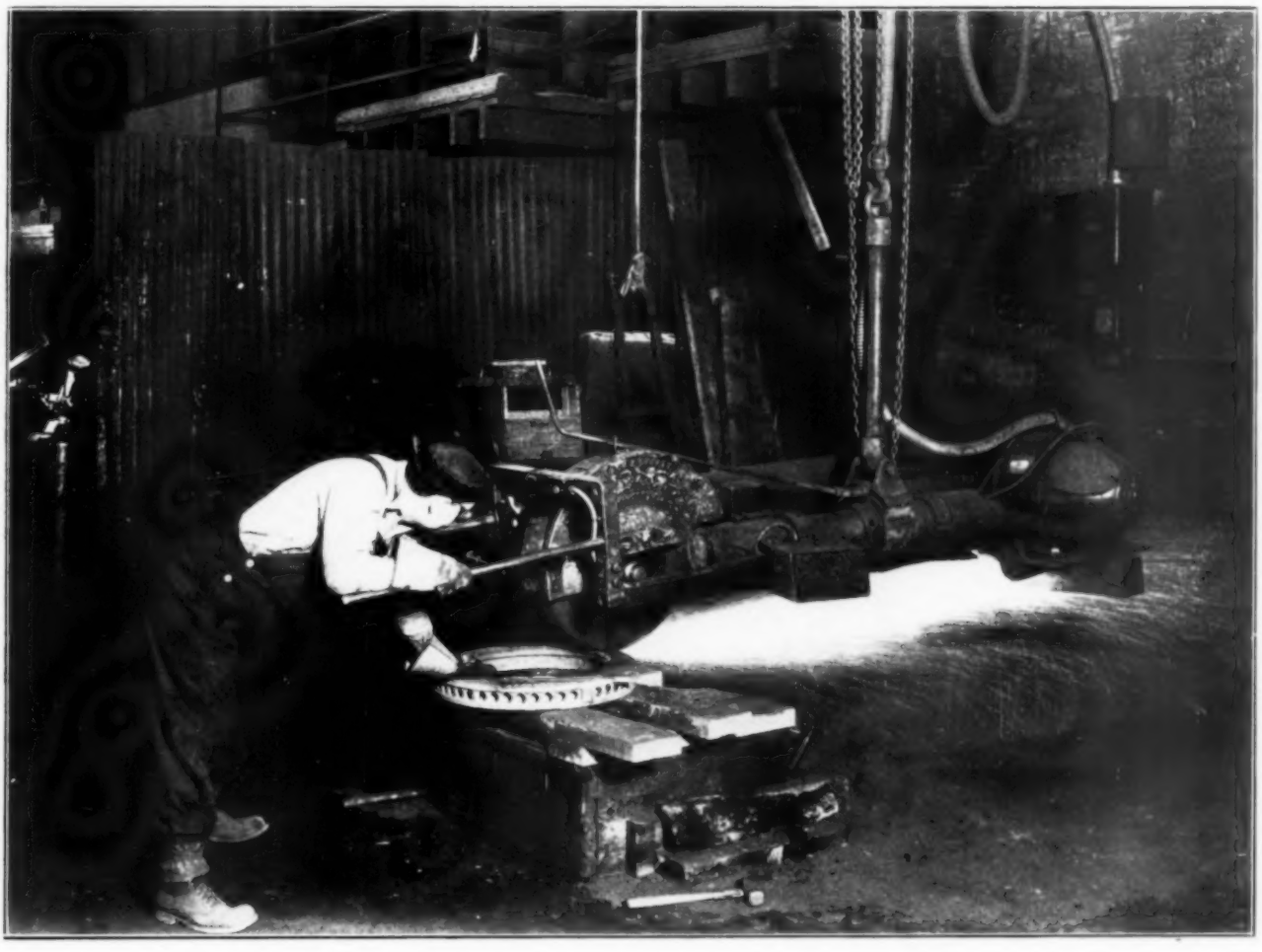
If sprue area *d* is much smaller than the gate area, there will be no point of arrest where the stream strikes the runner. The force of the stream would tear the mold at this point and the loose sand would ride into the mold cavity with the metal stream. If the cross sectional area of the runner is smaller than the sprue and branch gates, the flow of metal will be accelerated. This may be destructive to the runner, but it is also certain that an accelerated stream will play havoc in the gates. The gates near the sprue will cause the most trouble. When the runner is in the drag, all the products of the destructive acceleration would find their way into the mold cavity.

The total cross sectional area of the runner should be greater than the cross sectional area of sprue *d*. If the runner carries the metal in two directions as in Fig. 7, the runner area may be just a little larger than one half of the area of the sprue to be effective. If the sprue *d* is at a junction of two runners, a little more than one fourth of the area *d* in the runner is enough.

By having the cross sectional area of the runner greater than the sprue *d* cross sectional area, which in turn is slightly greater than the branch gate area, there will be a point of arrest in the flow of metal between sprue *d* and the branch gates. This will result in a body of metal in the runner that has the opportunity of arresting any loose particles of foreign material that find their way into the runner. Also the same body of metal will have minimum agitation and will supply nothing but clean metal from a bottom

(*Concluded on page* 80)

MACKLIN
FOUNDRY
WHEELS



Macklin Resinoid Wheels snagging fins and gates of steel castings. Protect your production by equipping your swing frame grinders and floor stands with durable Macklin Wheels.

MACKLIN COMPANY

Manufacturers of GRINDING WHEELS—JACKSON, MICHIGAN, U. S. A.

Sales Offices:—Chicago—New York—Detroit—Pittsburgh—Cleveland—Cincinnati—Milwaukee—Philadelphia

(*Concluded from page* 78)

opening to the branch gates. The only dirt that is left to get into the mold is what may be found in the branch gates. Fig. 8 is a pictorial presentation of the relations of the sprue, runner and gate cross sectional areas.

The foregoing has dealt with castings poured with hand ladles, but practically the same gate construction may be used on large castings. Only a few minor changes are necessary. The pouring cup does not lend itself so readily to large ladle pouring. The sprue is large, and in most cases would be impractical to stick closely to its relative dimensions. There would be an unnecessary waste of metal. Also the size of the ladle, amount of metal in it, and height of the mold would govern the distance of the ladle lip from the pouring cup. Where that is great, there would be a good deal of splashing. Also it would be difficult to keep the cup full and guide the stream to its proper place at the side of the cup.

For Medium Size Castings

The gate construction shown in Fig. 9 is effective in getting clean and sound castings for the average run of medium size castings poured with large ladles. It has been used on castings which weighed more than a ton, made in green sand, with sections 3 inches thick, and with a large area to be machined on the cope side. The castings were clean and free from any dirt.

A relief and skim sprue *I* is placed close to the slightly tapered pouring sprue *H*. All runners are cut deep in the cope. The short runner *K* connecting sprues *H* and *I* should be cut much higher than the runners *J* and *J'*. The branch gates are made similar to those for hand ladle work and it is best to have them 2 to 3 inches long from the runner to the mold cavity. The cross sectional area of the pouring sprue *H* is larger than the cross sectional area of the short runner *K* and the latter is greater than *J* and *J'*.

Sprue *I* relieves the mold and runners from the force of the energy in the stream dropping from the ladle to pouring sprue and also acts as a skimmer. It forms a point of arrest between the runner K and the main runners J and J'. All dirt that gets by *K* will float to the top in *I*.

Total cross sectional area of branch gates *XX'*, *ZZ'*, *OO'*, etc., should be slightly smaller than the cross sectional area of the main runners *J* and *J'*. However, this may vary either way without being detrimental in this case. The pressure in the runner is regulated by the height of the metal in *I*. The main thing is to choke sprue *H* as quickly as possible which in turn will choke at the main runner, allowing the dirt to be arrested at that point and flow to the top of *I*. Cross sectional area of the short runner *K* should be sufficiently large to allow metal to fill the runners *J* and *J'* and those runners easily are kept filled irrespective of their cross sectional area relation to the branch gates. A nozzling effect in the branch gates should be prevented. If the cross sectional branch gate area is smaller at the runner than at the mold cavity, and if it is sufficiently long, 1½ inches or more, there will be no destructive nozzle force left when the metal reaches the mold. This gate arrangement may be used on small castings.

Skim or strainer cores have their place and in many cases are indispensable, but for general practical purposes, good results may be obtained without them if proper gates are used. Skim cores placed in the gate system where they cannot be removed after pouring has stopped, will prevent the sprue and runner from feeding the casting.

Good gate feeding is an added feature of the gate system outlined. The branch gates are connected to the bottom of the runner, which in turn will remain liquid long after the branch gate is solid and in the majority of cases will feed the casting. The reverse is true where the shallow runner is in the drag and as a result the casting feeds the runner. In the cope runner type of gate construction the runner is under pressure and will force metal through the branch gate to the mold as long as the latter is in the liquid state.

The accompanying table shows the gate area in relation to the area of various size sprues. Also the number of branch gates ⅛-inch thick which each of these sprues will supply with metal. Other combinations may be arranged from the same data.

This completes the presentation of articles receiving honorable mention in THE FOUNDRY'S recent award contest. Other articles in the group appeared in the December 1935, and the January and February, 1936 issues.

THE EDITORS

Number and Ratio of Gates To Sprue

Sprue Diameter Inches	Area Square Inches	Gate Area Square Inches	Number and Dimensions of Gates
1	0.7854	0.75	Six, ⅛ x 1
⅞	0.6013	0.59	Five, ⅛ x ⅞
¾	0.4417	0.44	Four, ⅛ x ⅞
½	0.1963	0.184	Two, ⅛ x ¾

Steel Founders Elect Eight Directors

The following directors and their alternates were elected by the American Steel Founders' Society of America, New York: Division No. 1, Lee C. Wilson, Reading, Pratt & Cady Co., Reading, Pa.; division No. 2, George H. Chisholm, Atlas Steel Casting Co., Buffalo; division No. 3, Frank M. Robbins, Ross-Meehan Foundries, Chattanooga, Tenn.; division No. 4, D. C. Bakewell, Continental Roll & Steel Foundry Co., Pittsburgh; division No. 5, A. H. Anthony, Massillon Steel Casting Co., Massillon, O.; division No. 6, F. A. Lorenz Jr., American Steel Foundries, Chicago; division No. 7, Paul H. Leussler, Omaha Steel Works, Omaha, Nebr.; and division No. 8, J. P. Arnoldy, Warman Steel Casting Co., Huntington Park, Calif. Alternates for these men are as follows: Division No. 1, George R. Casey, Treadwell Engineering Co., Easton, Pa.; division No. 2, E. J. Mohr, Gould Coupler Co., Depew, N. Y.; division No. 3, A. L. Brainard, Beaumont Iron Works Co., Beaumont, Tex., and Raphael Ross, Diebert, Bancroft & Ross Co. Ltd., New Orleans, La.; division No. 4, C. L. Snowdon, Reliance Steel Casting Co., Pittsburgh; division No. 5, Kermit Donaldson, Machined Steel Casting Co., Alliance, O.; division No. 6, J. O. Houze, National Malleable & Steel Castings Co., Cleveland; division No. 7, Burtner Fleeger, Oklahoma Steel Castings Co., Tulsa, Okla., and division No. 8, E. R. Hinton, Olympic Steel Works, Seattle. Col. Merrill G. Baker has been re-elected executive vice president of the society and R. L. Collier, secretary-treasurer.

Reports on Work of Air Hygiene Foundation

Air Hygiene Foundation of America, Inc., held its first annual meeting at Pittsburgh on Feb. 11. The medical committee, headed by Dr. A. J. Lanza, assistant medical director, Metropolitan Life Insurance Co., reported on his program of collecting and evaluating available information relating to industrial dust diseases and disabilities resulting therefrom. The report described the amount and character of research now being carried on, particularly what phases may involve duplication of effort or should be extended.

The preventive engineering committee, headed by Prof. Philip Drinker, Harvard School of Public Health, outlined a program to be followed by industries having dust problems. H. B. Meller, Pittsburgh, is managing director of the foundation.

ADVERTISING PAGES REMOVED

Program for Detroit Convention

(*Concluded from page* 33)

Campbell, Wyant & Cannon Co., as discussion leader. The second session will be on "Bed Heights and Blast Pressures," with Fred J. Walls, International Nickel Co., as discussion leader. The third session will deal with the "Addition of Alloys in Melting" and G. P. Phillips, International Harvester Co., Chicago, will present the material for discussion. The fourth and concluding session will be on "Use of Pulverized Coal-Fired Rotary Furnaces in Melting Cast Iron," with J. H. Lansing, Kelsey-Hayes Wheel Co., Detroit, as discussion leader.

The sand shop course sessions will present some of the very practical and fundamental aspects of sand control for review and discussion. These sessions are essentially different from the more formal meetings on sand research, in that they are designed to show the shop operator how sand control may be installed to obtain practical benefits, opportunity being given for presentation of questions from the floor pertaining to some of the more every-day problems involved. The committee sponsoring these sand control sessions is composed of W. H. Spencer, Sealed Power Corp., Muskegon, Mich., as chairman, Charles Schofield, Gray Iron Foundry division, Chevrolet Motor Co., Saginaw, Mich., and Donald Yost, Budd Wheel Co., Detroit.

Organized Training Necessary

The apprentice training committee is continuing its plan of calling attention to the need for organized training of foundry apprentices and its session for the Detroit meeting will be unusually timely in view of the present shortage of skilled men in the foundry industry. H. W. Boulton, Murray Corp., Detroit, will outline the plan being carried out in Detroit under the sponsorship of the Employers Association of Detroit. Franklin R. Hoadley, Farrel-Birmingham Co., Ansonia, Conn., will present a discussion of the results obtained by his organization which has met with such success in its training program.

The apprentice committee will also have a display booth in the exhibit. Castings and patterns which have been entered in a national competition by apprentices from various plants throughout the country will be shown. A committee of judges will select the patterns and castings for awards in steel and iron molding and pattern making groups. Cash prizes have been provided by the awards board of the A.F.A.

The cast iron division, in addition to its shop operation course, will hold three technical sessions. The first will be devoted to papers on special features of cupola melting, with papers on "Determination of Height of Molten Metal in the Cupola," "Behavior of Manganese in the Cupola," and "Effect of Coke Below the Tuyeres."

The second session will be devoted to metallurgical phases of cast iron. At this session the I.B.F. Exchange paper on "Heat Treatment of Cast Iron by Hardening and Tempering" will be presented by J. E. Hurst, president of the Institute of British Foundrymen, and one of the foremost British authorities and writers on cast iron research.

The exchange paper of the French Foundry Technical association, on "Heat Treated Cast Iron," by M. Ballay and R. Chavy, two noted French authorities, will be presented at that session. Results of an investigation of the "Effect of Copper and Copper-Manganese in Cast Iron," carried out at the Michigan School of Mines and Technology, will be reviewed by members of the metallurgical staff of that school.

A third session is to be devoted to the discussion of the material on alloy cast iron being collected by a division committee. This report is an attempt to summarize the existing data on the use of alloys in cast iron, presenting theories, foundry practice and practical applications.

The steel division will present a program dealing with finishing steel castings, committee reports on subjects which have been under investigation, and the fourth paper in a series dealing with "Contraction of Steel Castings," work which has been carried out by Messrs. C. W. Briggs and R. E. Gezelius at the Naval Research Laboratories at Washington. Their paper this year will deal with free and hindered contraction of alloy steel castings.

A round table conference on current steel foundry problems will be held under the chairmanship of A. H. Jameson, Malleable Iron Fittings Co., Branford, Conn.

The nonferrous division will hold two sessions at which papers on foundry practice pertaining to special alloys will be discussed. The papers this year will deal with silicon bronze, aluminum bronze, and manganese bronze, combining both shop practice data and alloy properties. In addition, the recommended practice committee expects to have ready for discussion three or four practices which are being added to the series which will later be published in a handbook on nonferrous alloys.

The nonferrous round table conference is being organized by a committee, T. C. Watts, Falcon Bronze Co., Youngstown, O., is chairman. Other members are Harold J. Roast, Canadian Bronze Co., Montreal, and H. J. Rowe, Aluminum Co. of America, Cleveland. This committee is planning some special features to make the round table meeting different from those which have preceded.

The malleable cast iron division has scheduled three meetings—one to deal with melting and metallurgical topics, one with sand control problems as applying especially to the malleable foundry, and the annual round table meeting for discussion of current foundry problems as presented by members at the meeting.

A feature of the metallurgical meeting will be an extensive paper, comparing costs, metallurgical control and quality of metal produced in various types of furnaces melting iron for malleable castings. This paper is the result of a series of investigations carried out at the Central Institute of Scientific Research for Machine Construction, U.S.S.R., comparing cupola, electric, air and rotary type furnaces and their combinations.

At the sand session a special report will be presented by H. W. Dietert comparing sands used in actual practice in a large number of malleable plants.

Foundry Equipment Manufacturers Elect

R. S. Hammond, Whiting Corp., Harvey, Ill., was elected president of the Foundry Equipment Manufacturers' association at a meeting held in Cleveland on Feb. 8. B. C. Trueblood, Arcade Mfg. Co., Freeport, Ill., was named vice president. The following were elected directors for a 3-year term: E. O. Beardsley, Beardsley & Piper Co., Chicago; R. W. Hisey, Osborn Mfg. Co., Cleveland; and T. Kaveny Jr., Herman Pneumatic Machine Co., Pittsburgh. Arthur J. Tuscany was renamed executive secretary.

Attendance at the meeting was highly satisfactory. A feature of the program was the discussion of the plans for the coming exhibition of foundry equipment and supplies at Detroit. Members present at the F.E.M.A. annual meeting are anticipating an exceptional exhibition and convention in May.

Company Gets Award

Mathews Conveyor Co., Ellwood City, Pa., has received the official "Award of Merit" issued by the Rice Leaders of the World association. Elwood E. Rice, LL.D., is founder of the association.

Founding Magnesium Alloys

(*Continued from page* 29)

in the pores, is accomplished by heating the castings in an engine oil bath at approximately 250 degrees Fahr. A subsequent kerosene wash removes adhering engine oil.

All of the present Dowmetal sand casting alloys are amenable to heat treatment with marked improvements in mechanical properties. Both the solution and the precipitation methods are used, depending on

Fig. 13 — Portable mine drill made from magnesium castings

properties required. The solution heat treatment (H. T. No. 1) of the Mg-Al-Mn alloys consists of 16 hours heating at 775 degrees Fahr. It increases the tensile strength, toughness, and percentage elongation of the alloys. The smaller percentage aluminum in the Mg-Al-Mn-Zn alloys permits a lower heat treating temperature (H. T. No. 1a) and this is desirable to avoid the hot-short temperature zone.

The aging or precipitation heat treatment (H. T. No. 3 and H. T. No. 3a) is given to the solution heat treated material and in both types of alloys is substantially complete after 16 hours at 350 degrees Fahr. This treatment raises the yield strength and hardness of the alloys with a lowering of ductility and toughness. Properties intermediate between those of the solution heat treated and the fully aged conditions are sometimes desired and can be obtained by giving the alloy a partial or short-time precipitation heat treatment (H. T. No. 2 and 2a). The successful heat treatment of the Mg-Al-Mn-Zn type of alloy has been a decided factor in causing that alloy partially to supplant the older Mg-Al-Mn alloys. It yields a combination of properties together with improved corrosion resistance heretofore not obtained on magnesium alloys. The properties of these different alloys in the more widely used conditions are given in Table II.

Accurate temperature control is important in heat treatment, the same as with many other metals. This is particularly true with the solution heat treatment which is carried out at a temperature close to the softening point of the alloy. Electrically heated ovens equipped with automatic temperature control and fans that give periodic reversals in direction of the circulating atmosphere insure the proper temperature regulation.

Magnesium alloys are remarkably stable under ordinary conditions of exposure and in many cases require no painting. However, in view of the fact that it is difficult to control the location and service conditions of any given article, most castings are given suitable paint coatings.

Prior to painting, the metal surface must be cleaned to remove adhering dirt and grease and then given a chemical treatment to insure best results. Oxide films and dirt generally are removed mechanically by sandblasting or wire brushing. Oil and grease are removed by washing with a solvent, such as carbon tetrachloride or gasoline, or are removed by treatment in hot alkaline cleaners. The immunity of magnesium alloys to alkalies permits the use of strong alkaline cleaners as used on steel. This treatment is best conducted at the boiling temperature and should be followed by a thorough washing in hot water.

Cleaned castings are then given the chrome-pickle treatment. This consists of a ½ to 2 minute dip in

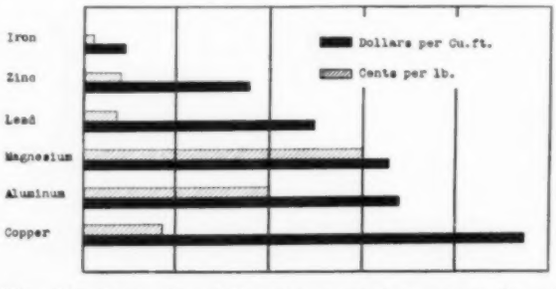


Fig. 15—Cost of various pure metals on pound and volume basis

a solution containing 1.5 pounds of sodium bichromate and 1.5 pints of concentrated nitric acid per gallon of solution. Upon removal from this bath, castings are allowed to drain for a few seconds and then are washed thoroughly in hot water. This treatment gives the metal an excellent *tooth* which increases the adhesion of subsequent paint coatings. The successful painting of magnesium castings offers no unusual difficulties where approved materials are used and good painting practice is observed. Selection of the primer is important in view of the fact that all representatives of a given class of paints do not show the same service performance. Vehicles with maximum imperviousness to water are best, particularly where castings will be exposed to severe corrosion conditions. Zinc chromate pigments in the primer usually are beneficial in service near salt water or continuous moist air. Baking primers are recommended on small castings be-

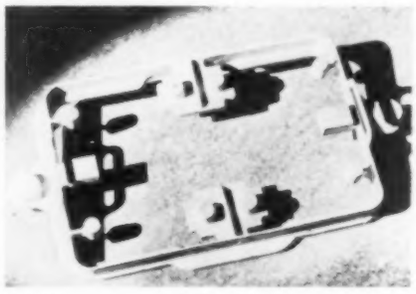
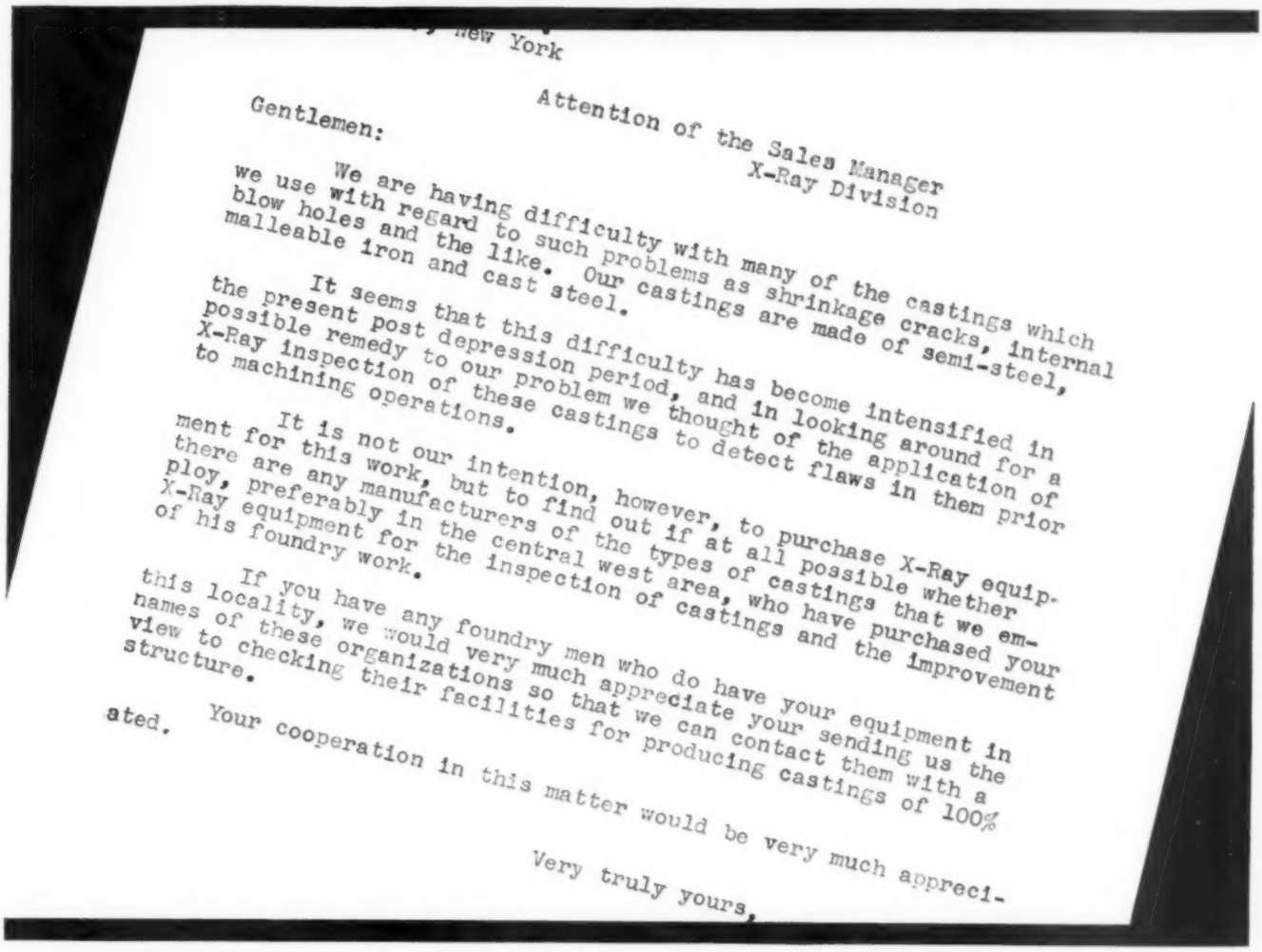


Fig. 14—Core setting jig made of cast magnesium

cause of their excellent adhesion. The choice of surfacer and finish coats is likewise important, although perhaps not so exacting as in the case of primers. Full synthetic and oil base synthetic enamels represent the better class of products, particularly for outdoor service. General recommendations tend to be abstract and indefinite, while a specific recommendation would appear to favor one particular paint product. As a result, the user of magnesium castings would do well to obtain the correct paint schedule for his purpose from those companies who have studied this subject.

Lightness is the outstanding characteristic of magnesium alloys and largely is responsible for many of their present uses. An ever increasing number of industries are based on the possibilities of light weight construction. This is especially true in the field of transportation and portable equipment. Magnesium alloys have inherently good strength properties and, when likewise considered from the standpoint of lightness, are found to possess strength-weight ratios distinctly superior to those obtained with many other cast metals. Table II gives the properties of our present Dowmetal casting alloys in the as-cast and heat treated conditions. These data are based on values obtained from test specimens cast as illustrated in Fig. 5. Tension specimens cut from commercial castings average about 75 per cent of

COULD YOUR FOUNDRY GET THE ORDER FROM THIS COMPANY?



New York

Attention of the Sales Manager
X-Ray Division

Gentlemen:

We are having difficulty with many of the castings which we use with regard to such problems as shrinkage cracks, internal blow holes and the like. Our castings are made of semi-steel, malleable iron and cast steel.

It seems that this difficulty has become intensified in the present post depression period, and in looking around for a possible remedy to our problem we thought of the application of X-Ray inspection of these castings to detect flaws in them prior to machining operations.

It is not our intention, however, to purchase X-Ray equipment for this work, but to find out if at all possible whether there are any manufacturers of the types of castings that we employ, preferably in the central west area, who have purchased your X-Ray equipment for the inspection of castings and the improvement of his foundry work.

If you have any foundry men who do have your equipment in this locality, we would very much appreciate your sending us the names of these organizations so that we can contact them with a view to checking their facilities for producing castings of 100% structure.

Your cooperation in this matter would be very much appreciated.

Very truly yours,

This letter, from a manufacturer in the Middle West, is a fair sample of the inquiries that come to our office. The logical answer is merely the name of a progressive foundry using x-ray equipment for radiographic inspection of castings.

Write to Dept. 123 for complete information on x-ray equipment and inspection methods that will help you produce castings to fit the severest specifications.

GENERAL ELECTRIC X-RAY CORPORATION

2012 JACKSON BLVD. CHICAGO, ILLINOIS

(*Concluded from page* 84)

the strength of separately cast bars. The alloys in the as-cast condition are satisfactory for a wide variety of applications but they are heat treated when service conditions demand maximum strength.

Lightness is also an important factor in determining the cost of castings. Ingot metals are usually sold on a weight basis, but in castings the volume is established and the corresponding weight depends on the gravity of the metal. Figure 15 shows that although magnesium is more expensive on the basis of cost per pound than some of the other metals used in the production of casting alloys, it ranks very favorably when figured on the basis of cost per unit volume.

Machinability Is Feature

The user of magnesium castings often is able to capitalize on the excellent machinability of this metal since this characteristic sometimes permits the obtaining of finished castings at a lower figure than when made from some other metal with a lower basic price per pound. This is particularly true when machining costs constitute a large percentage of the total cost. In addition to the high speed permissible in machining operations, the power consumption per cubic inch of metal removed is less than with other metals recognized as having good machining qualities.

Typical applications of magnesium alloys include aircraft parts, such as crank cases, starting equipment, instrument housings, landing and tail wheels, and landing gear assembly; handles, motor cases, and different coverings in portable electric and pneumatic tools; appliances for office equipment; reciprocating and rotating parts on textile, packaging, and conveying equipment; safety blocks for sheet metal presses; and foundry equipment, such as flasks, match plate patterns, core boxes, and core setting jigs. A few of these applications are illustrated in Figs. 9 through 14. These uses of magnesium castings are supplemented by other magnesium alloys in the form of sheet, forgings, and structural shapes which possess the same basic characteristics,—lightness, machinability, and high strength-weight ratio, that are present in the castings.

Magnesium alloy castings have been produced in the United States for approximately 16 years. Accurate production data are not available for the first 8 years, but government reports for the past 8 years show a steady increase in annual production (except for a slight drop in 1930), resulting in a 1934 production nine times as large as that of 1927. Numerous factors are responsible for this rapid expansion, including the availability of commercial alloys and methods of fabricating them. More important, however, is the rapid disappearance of prejudice and inertia that so often oppose the introduction and use of a new material, and their replacement by service tests that prove the dependability of these magnesium alloys.

Pittsburgh Group Hears Talk on Silicosis

Over 75 members and guests of the Pittsburgh Foundrymen's association attended the regular monthly meeting Feb. 17. Following dinner at the Fort Pitt hotel, the speaker of the evening, H. B. Mellor, managing director of the National Air Hygiene Foundation, spoke on "Silicosis and Anthraco-Silicosis."

Mr. Mellor was one of two speakers at the foundrymen's January meeting and his subject, though touched upon briefly at that time, created so much interest among the Pittsburgh foundrymen that he was asked to present a full evening's program in February.

The Pittsburgh Foundrymen's association, through Richard H. Stone, chairman of the program committee, has tentatively arranged several speakers for the March, April and May meetings.

Detroit Chapter Discusses Refractories

L. C. Hewitt, director of research, Laclede-Christy Clay Products Co., St. Louis, presented an interesting paper at the regular meeting of the Detroit Chapter of the American Foundrymen's association held at the Wardell hotel, Detroit, Thursday, Feb. 20. Mr. Hewitt gave numerous factors which must be taken into consideration in the application of refractories to the foundry industry. Several reels of motion pictures illustrating the production, manufacture and uses of fire clay products followed the presentation of the paper.

Vaughan Reid, City Pattern Works, Detroit, and president of the Detroit chapter, announced the chairmen of the various committees which will handle activities in connection with the annual meeting of the American Foundrymen's association to be held in Detroit, May 4-9.

Handles Nozzles

Federal Foundry Supply Co., 4600 East 71st street, Cleveland, with offices in Detroit and Charlerol, Pa. has been appointed distributor for the line of Titan blasting nozzles manufactured by Mills-Alloys, Inc., 3202 S. San Pedro St., Los Angeles.

Properties of Cast and Heat Treated Magnesium

Alloy	Composition Mg	Al	Mn	Zn	Condition	Tensile Strength, lb. per sq. in.	Yield Strength (set:0.2), lb. per sq. in.	Elongation in 2 in., per cent	Compressive Strength, lb. per sq. in.	Shear Strength, lb. per sq. in.	Rockwell "E" Hardness	Brinell Hardness	Impact Izod, ft.-lb.	Fatigue Endurance Limit, lb. per sq. in.
A	Remainder	8.0	0.2	...	As-cast	24,000—28,000	10,000—13,000	3—7	44,000—48,000	16,000—18,000	53—60	47—51	2—4	6,000—8,000
					H.T. No. 1	32,000—36,000	10,000—13,000	8—12	44,000—48,000	16,000—18,000	53—59	47—50	5—7	6,000—8,000
G	Remainder	10.0	0.1*	...	As-cast	21,000—24,000	12,000—15,000	1—3	47,000—50,000	16,000—18,000	62—68	52—57	1—3	8,000—10,000
					H.T. No. 1	30,000—35,000	11,000—14,000	6—9	48,000—52,000	18,000—20,000	58—66	49—55	3—6	9,000—11,000
					H.T. No. 3	31,000—36,000	17,000—21,000	1—4	52,000—57,000	20,000—22,000	76—84	65—75	1—3	8,000—10,000
B	Remainder	12.0	0.1	..	As-cast	19,000—23,000	15,000—17,000	0—1	45,000—49,000	15,000—17,000	69—73	57—61	0.5-2	.....
					H.T. No. 3	27,000—32,000	20,000—24,000	0—1	52,000—57,000	17,000—19,000	82—90	72—85	0.5-2	.....
H	Remainder	6.0	0.2	3.0	As-cast	25,000—30,000	11,000—13,000	4—8	.....	.....	54—61	47—51	2—5	9,000—11,000
					H.T. No. 1a	33,000—38,000	11,000—14,000	9—13	.....	.....	59—64	50—53	4—6	9,000—11,000
					H.T. No. 3a	37,000—42,000	18,000—21,000	3—7	.....	.....	76—82	65—72	1—3	9,000—11,000

Yield strength is defined as the stress at which the stress-strain curve deviates 0.2 per cent from the modulus line.
Modulus of elasticity of Dowmetal is 6,500,000 lb. per sq. in.
Tensile and hardness values are obtained on standard unmachined 0.5 in. diameter tension test specimens.
Compression and shear values are obtained on ¾ in. diameter specimens machined from 1 in. diameter bars.
Fatigue endurance values are obtained on R. R. Moore machines using specimens machined from ⅝ in. diameter bars.
Impact values are obtained on Izod type specimens cast in a graphite mold. Specimens are 10 millimeters square with a 45 degree notch having a depth of 2 millimeters and a radius at the bottom of 0.25 millimeter, according to A.S.T.M. Tentative Standard E23-33T.

ADVERTISING PAGES REMOVED

European Foundry Practice

Digest of recent literature covering various phases of castings manufacture

Aluminum in Iron

The Influence of Aluminum on the Properties of Ordinary Cast Irons. (Influence de l'Aluminium sur les proprietes des fontes ordinaires), by Marcel Ploye. *Revue de Metallurgie*, Paris, July, 1935. (Concluded)

In the first article cast iron with additions of aluminum ranging from 0.02 to 0.25 per cent was considered. Iron with additions of aluminum ranging from 0.5 to 20 per cent also was studied from the standpoints of chilling effect, chemical analysis and micrographic structure. This article is concerned with the dilatometric test and the physical properties of these irons.

Dilatometric tests show that the critical points where pearlite begins to be modified during heating and during cooling occur at a higher temperature as the content of aluminum increases, until it reaches 8 per cent of aluminum when pearlite disappears altogether. Above 8 per cent of aluminum, the graphitization of cast iron does not take place; below 8 per cent the temperature at which graphitization begins is lowered.

When the temperature is maintained at 800 degrees Cent. during two hours, the addition of aluminum up to 4 per cent increases the value of the expansion of the cast iron, but in a lesser degree than is the case with additions of silicon. Above 4 per cent of aluminum, expansion decreases and disappears for 8 per cent of aluminum.

Hardness tests show that up to 8 per cent, aluminum increases the hardness progressively, up to about 300 brinell; from 8 to 15 per cent there is a rapid increase up to 550; from 15 to 18 per cent hardness decreases.

Shearing tests show that up to 2 per cent of aluminum there is a rapid increase in shearing strength; then the strength continues to increase slowly up to 8 per cent of aluminum; beyond 8 per cent the strength drops suddenly but it begins to rise again between 15 and 18 per cent of aluminum.

The results of the static transverse test increase up to one per cent of aluminum; they drop slowly from 2 to 8 per cent and rapidly from 8 to 15 per cent; they then increase from 15 per cent aluminum upward, but remain below the results of the control test piece made with the original iron without aluminum addition. The author then gives the relations between the microstructure and the mechanical properties.

The influence of aluminum on the resistance of cast iron to high temperatures has been studied, and between 4 and 6 per cent of aluminum growth decreases, and disappears completely between 8 and 20 per cent. It was also found that aluminum increases the resistance of cast iron to oxidation at high temperatures.

It was also shown that in the hardening of cast iron by nitriding, the addition of aluminum tends to increase the hardening effect. Three series of tests were made, one during 15 hours exposure to the gas, one during 50 hours and one during 80 hours. Only machinable irons with no more than 8 per cent aluminum were tested; the tests took place at a temperature of from 525 to 530 degrees. It was found that the time factor did not have much influence on the superficial hardness. A Rockwell diamond testing machine was used.

This machine also showed, by the shape of the edges of the indentations, to what extent the superficially hardened surface of the test piece was fragile. It was found that brittleness increased with the duration of the nitriding period and with the content of aluminum.

The thickness of the hardened surface was measured micrographically. It was found that this thickness increased with the content of aluminum, up to two per cent, and then decreased for higher percentages; furthermore, the presence of aluminum tends to make the separation between the hardened part and the mass of the castings more precise. It was found also that as the hardened surface increases in thickness, the hardness itself decreases.

Corrosion tests were made with irons containing from 8 to 18 per cent aluminum. In diluted sulphuric acid it was found that irons with 8 per cent aluminum were attacked strongly. Corrosion then decreased up to 15 per cent aluminum and increased again up to 18 per cent. Briefly, aluminum did not assist resistance to corrosion by diluted sulphuric acid.

With diluted hydrochloric acid aluminum additions increased resistance up to 15 per cent. With diluted nitric acid, aluminum additions up to 15 per cent also increased resistance to corrosion.

The resistance to corrosion by salt water mist was increased by aluminum additions ranging from 8 to 15 per cent; above 15 per cent there was a slight increase of corrosion. From 8 to 15 per cent of aluminum, the resistance to corrosion by sea water is increased.

The general conclusions of the two articles point toward an improvement of cast iron by aluminum additions, mainly from the standpoint of oxidation at high temperatures, and corrosion by sea water.

Book Review

Aluminum Alloys (Aluminium- Legierungen), by A. Gruetzner and G. Apel, paper, 7 x 10¼ inches, 342 pages, published by Verlag Chemie, Berlin, Germany, and supplied by THE FOUNDRY, Cleveland, and in England by the Penton Publishing Co. Ltd., London.

This book which is in German is one of a series that form Gmelins Handbuch der Anorganischen Chemie, and it is a tabulation of patents on aluminum alloys from 1887 to and including May, 1935 which have been granted in Germany, England, France, Austria, Switzerland and the United States. Arrangements of the various patents is such as to permit ease of location, and consists of three columns of which the first lists the most important elements and percentages, exclusive of aluminum which is assumed to be the remainder in all cases.

The elements are arranged alphabetically according to their chemical symbols, and begin with silver (Ag). The second column briefly states properties or applications of the alloy, and the third cites the inventor and the patent number. Due to the large list of patents, the work will be divided into 2 sections; this covering alloying agents alphabetically to thallium (Th). The second will relate to those containing titanium (Ti) to zirconium (Zr), and in addition contain tradenames of various alloys.

Obituary

HARRY B. PARKER, 65, president and general manager, Albion Malleable Iron Co., Albion, Mich., died at his home, Feb. 10. Mr. Parker was born in Chicago, Nov. 21, 1871. He went to Albion in 1899, and with his stepfather, W. S. Kessler, founded the Albion Malleable Iron Co. He worked in various departments of the plant, and in 1892, was made vice president. Seven years later he became assistant general manager, and when Mr. Kessler retired in 1910, succeeded to the post of general manager. When Mr. Kessler died in 1933, he took over the added duties of president. In partnership with Mr. Kessler, he also built the Parker-Kessler block in 1900, one of Albion's largest buildings.

♦ ♦ ♦

Washburn A. Barnhurst, 80, treasurer of the H. Belfield Co. of Philadelphia, died in Kearney, N. J., Jan. 21.

♦ ♦ ♦

William B. Ross, 71, president of the Edwin S. Woods Railway Supply Co., Chicago, died in that city Feb. 2.

♦ ♦ ♦

Archie J. Kennedy, 65, president of the Sandy Hill Iron & Brass Works Inc., Hudson Falls, N. Y., died in Poughkeepsie, N. Y., Feb. 16.

♦ ♦ ♦

Joseph Healey, 70, formerly associated with his brother in the operation of the Peter Healey Brass Foundry, Evansville, Ind., died at Tampa, Fla., recently.

♦ ♦ ♦

J. J. Sweeney, 84, for 30 years superintendent of the International Nickel Co.'s Bayonne, N. J., plant, died at his residence in New Brighton, Staten Island, Feb. 26.

♦ ♦ ♦

James A. Fitzgerald, 71, one of the founders of the Fanner Mfg. Co., Cleveland, died Feb. 26 at his home after a short illness. He had been connected with the Fanner company since he came here from Canada more than 40 years ago.

♦ ♦ ♦

Frederick A. Lange Sr., 72, founder of the Crucible Steel Casting Co., Milwaukee, died at New Orleans, La., Feb. 2. A native of Germany, he served his molder's apprenticeship in Chicago, then moved to Milwaukee and began work as a molder for the Wisconsin Malleable Iron Co. Subsequently he worked for the Allis-Chalmers Mfg. Co., and the J. A. and P. E. Dutcher Co.

In 1893 he entered business with the late Charles Maynard, and 10 years later he became sole owner. He organized the Southside Malleable Casting Co. in 1906 and was president of both concerns until his retirement in 1924.

Upon retirement he turned active direction of the companies over to his three sons, Albert C., Walter W., and Fred A. Lange Jr.

♦ ♦ ♦

Joseph Burt Clough, 66, manager of the forge department of the Johnson & Jennings Co., Cleveland, died recently, at his home in Cleveland Heights, O. Born and educated at Marine City, Mich., he came to Cleveland about 40 years ago. For a time he was employed by the Coal & Iron Bank, and later by the First National Bank.

♦ ♦ ♦

Talbot G. Shipley, 62, general superintendent of American Car & Foundry Co. in St. Louis, died recently. A native of Bowling Green, Ky., he entered the employ of this company when 15 years old and has served continously since that time. The steel department in St. Louis was erected under the supervision of Mr. Shipley in 1905.

♦ ♦ ♦

Henry Horkman, president and general manager, Neenah Brass Works Inc., Neenah, Wis., died recently. Mr. Horkman was born at Bay Settlement, Wis., April 7, 1856. He was one of the founders of the Neenah Brass Works which was organized in 1904, and was made president and general manager in 1918. He was active in business until 3 years ago.

♦ ♦ ♦

George V. Salg, 46, foundry superintendent, Fulton Iron Works Co., St. Louis, died in that city Feb. 1. He became superintendent of the foundry in 1916 following service as a molder and later as foreman. Mr. Salg's other industrial associations included several years with the Excelsior Tool Co., East St. Louis, Ill., and with the Calumet Foundry & Machine Co., East Chicago, Ind., where he was foundry superintendent at one time.

♦ ♦ ♦

HENRY J. HARTMANN, founder and president of the H. J. Hartmann Foundry Co., Grand Rapids, Mich., died in that city Jan., 15 at the age of 77. Mr. Hartmann was born in Grand Rapids June 21, 1859. He learned the molding trade under direction of his father and after several years experience in other foundry centers he returned to Grand Rapids and established his own gray iron foundry in 1885. Always keenly interested in his chosen avocation he joined the American Foundrymens association a few months after its formation and frequently referred to the fact that he had been a subscriber to THE FOUNDRY since the issue of No. 1, Vol. 1, was published in Detroit, Sept., 1892.

♦ ♦ ♦

Edward D. Frohman, 62, vice president and general manager of the S. Obermayer Co., Pittsburgh, died aboard the FRANCONIA near India, Feb. 28, enroute on a world's cruise. Aside from managing the Obermayer plant in Pittsburgh, Mr. Frohman was a director of the Penn-Rillton Co. and the Marine Mfg. & Supply Co.

♦ ♦ ♦

George H. Letz, 50, president of the Letz Mfg. Co., Crown Point, Ind., manufacturer of farm implements, died in Chicago, Feb. 25. The company was founded 50 years ago by his father, Louis H. Letz. He was a graduate of Armour Institute of Technology, Chicago, and for the past 3 years was treasurer of Valparaiso university, Valparaiso, Ind.

♦ ♦ ♦

Frederick Shearer, vice president of the European advisory board of the American Radiator Co., New York, since 1919, died in Paris, France, Feb. 16. Starting as a clerk, Mr. Shearer has been associated with the company since 1898. Later he became a salesman in the New York territory, and subsequently was transferred to London as assistant managing director of the British affiliate of the company. Later he was made managing director.

♦ ♦ ♦

W. F. Mandel, 39, secretary and treasurer, Kensington Steel Co., Chicago, died recently. Mr. Mandel was born in La Grange, Ill., March 8, 1897, and was educated in the public schools of that city. He received his bachelor of arts degree from the University of Wisconsin. After serving as a public accountant he joined the Kensington Steel Co. in 1924. In addition to his duties as secretary and treasurer, Mr. Mandel was in charge of purchases.

♦ ♦ ♦

Herbert F. Perkins, 71, former president of International Harvester Co., Chicago, died in Ojai, Calif., Feb. 1. Mr. Perkins was graduated from Yale university in 1887 and became associated with the McCormick Harvester Co., Chicago, in 1899. He continued with that company's successor, International Harvester Co., and served as first vice president from 1928 until 1929. He then succeeded Alexander Legge as president, holding this position until 1931 when he retired.

MODERN

SEALED HEAT!

A new foundry necessity which enables distributing large quantities of metal over long periods of time.

How Nash Motors Co. uses *Modern SEALED HEAT* to more perfectly synchronize its pouring and molding operations.

1. Filling a Modern 1 ton Covered and Insulated Ladle from a reservoir ladle.

2. Not a sign of any escaping heat as the ladle is transported to the extreme end of the foundry.

3. Tapping off 500 pounds of metal from the Modern Insulated Ladle, which is held 30 to 45 minutes, and longer, and the metal taken from it as needed.

MODERN

Covered and Insulated Ladles
Lifetime Geared Ladles
Improved Bottom-Pour Ladles
Metal Pouring Systems
Crane and Monorail Systems for Metal and Mold Handling
Furnace Charging Cranes
Sand Conditioning Systems

Patented & Patents Pending
Dept. 118

MODERN EQUIPMENT CO.
PORT WASHINGTON, WIS.

MODERN EQUIPMENT CO.

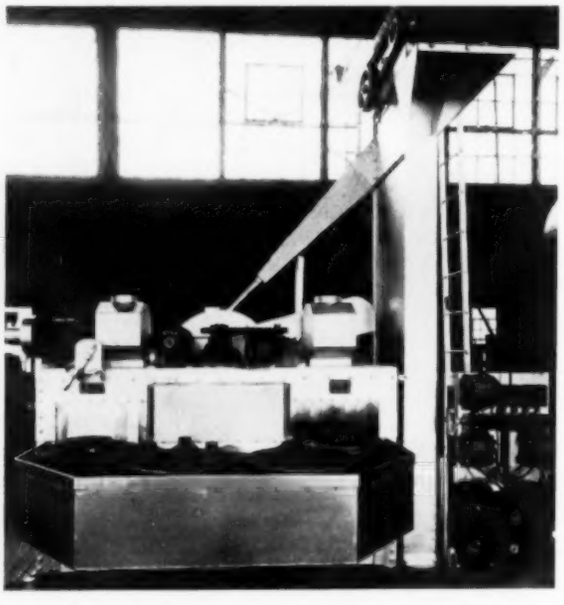
NEW EQUIPMENT . . . . for foundries

Blasting Unit Has Rotating Work Tables

American Foundry Equipment Co., 555 Byrkit street, Mishawaka, Ind., has introduced a multirotary blasting table, consisting of a number of independent tables with a guide under the center of each, running on a 6-foot track directly under a Wheelabrator unit. The tables are directed under the blast so that the work will receive the full effect of the abrasive as it leaves the wheel.

The flat vertical side of the table contacts a variable-speed belt revolving the tables as they pass under the blast. The turning speed as well as the forward speed of the table can be varied. After traveling under the blast, the tables move where the castings can be removed or turned over for a second trip through the blast chamber.

The abrasive is fed from a hopper overhead to the center of a specially designed wheel. The blades of this wheel throw the abrasive by centrifugal force on the work to be cleaned. The abrasive is controlled as to volume and direction of blast. Used abrasive falls into a hopper which feeds to a screw conveyor leading back to the overhead hopper for reuse.



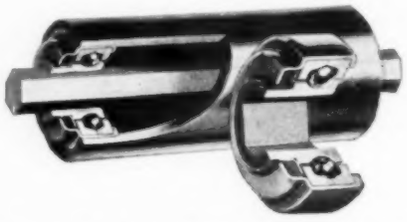
The turning speed as well as the forward speed of the table can be varied

Shows Continuous Blue Printing Machine

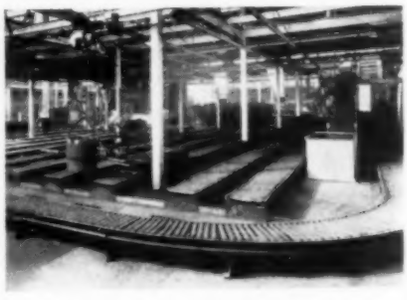
C. F. Pease Co., 813 North Franklin street, Chicago, recently has placed on the market a recent development in blue printing machinery, a mercury vapor tube continuous printer. The new model is of the horizontal type, modernly styled in upright console design with pedestal type base. The machine may be set up close to the wall to save floor space. It may be operated continuously or on single sheets. Tracings and sensitized paper are fed into the machine at the front over the feed table and on to an endless belt which carries them upward, around and through the machine in close contact with a curved section of highly polished plate glass where exposure takes place. After exposure, tracings and paper are returned to the tray at the front of the machine. To facilitate the making of prints in continuous operation, two movable hangers extend downward vertically from the feed table and a ½-inch steel rod is provided for holding a roll of paper up to 100 yards in length. Uniform illumination is provided by an arrangement of 3½ ampere, 50-inch mercury tubes mounted in close proximity to the curved section of the polished contact glass. The machine may be equipped with either three or four mercury tubes depending upon the intensity of illumination and speed of operation desired. Three tubes provide a printing speed of 2 linear feet per minute. The speed with four tubes is 2½ feet per minute.

Roller Conveyor Axle Is Hexagonal Shaped

Mathews Conveyor Co., Ellwood City, Pa., recently has incorporated hexagon shaped axles in its line of



The roller is available in a variety of lengths



Assembled roller conveyor in use in a foundry

ball bearing roller conveyors. This development will embrace practically all the available sizes plus several intermediate sizes not heretofore produced.

Construction of the new roller is shown in the accompanying illustration. Seamless steel tubing, hardened steel bearing parts, solid steel inner and outer ball races predominate in this line of roller conveyors. Ball bearing rollers in a variety of lengths to suit are available ranging from 1 inch to 75⅛ inches, with capacities ranging from 50 pounds continuous load rating to 8000 pounds.

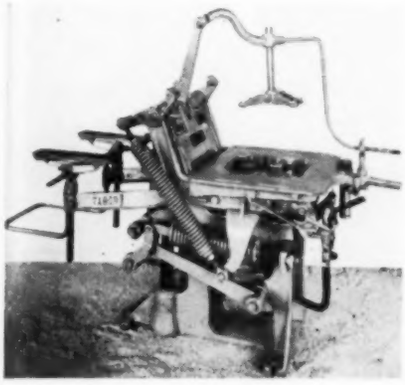
New Silica Plant

Sayler Sand Works, Ottawa, Ill., will erect a plant on silica sand acreage soon, located on an island in the Illinois river near Ottawa. Deliveries to consumers will be made by barges and trucks.

ADVERTISING PAGES REMOVED

Molding Machine Has Foot Draw Device

Tabor Mfg. Co., 6223 Tacony street, Philadelphia, has introduced a 20-inch, power jar, hand roll, foot draw molding machine, similar in design to the hand draw machine of that company. A double guide is provided to accommodate the heavier loads, with each guide designed to be sand-proof and dust-proof.



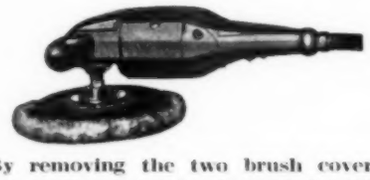
Counter-balance mechanism is actuated by heavy adjustable coil springs

The counter-balance mechanism is actuated by heavy coil springs readily adjustable to handle a wide variation of loads. It is designed to be independent of wear in pins and fulcrums.

Equipment includes a four-point leveling device having metal coreplate supports with a simple adjustment to take up wear. The machine is operated by a conveniently-located, quick-acting gate valve. The jarring head and rollover plate are built of steel, and are interconnected to prevent fluctuation during jarring, regardless of length of the flask or core box.

Electric Polisher May be Inspected Easily

Independent Pneumatic Tool Co., 600 West Jackson boulevard, Chicago, has added a portable electric polisher to its line of electric tools. Both the armature and the spindle of this mechanism run in ball bearings.



By removing the two brush covers, the motor may be inspected while running

The machine is so designed that it can be taken apart for inspection and cleaning. By removing the two brush covers, the motor can be inspected while running. The handle can be used on either side of the machine to accommodate the operator. Equipment includes one 7-inch felt pad, one 7-inch flexible rubber pad, and one 8-inch sheep wool pad.

Sprays Layer of Oil On Foundry Floors

Mekeel Engineering Co., 6318 West State street, Milwaukee, has developed a pressure oil sprayer, for use in oiling foundry aisles, cleaning room, core and shipping room floors, etc. As shown in the accompanying illustration, the unit is carried on the back of the operator and pressure is provided by working a lever with the right hand. This sprayer has four main parts, consisting of the body of the machine, the pump operating lever, the discharge hose with valve, and brass rod with nozzle.

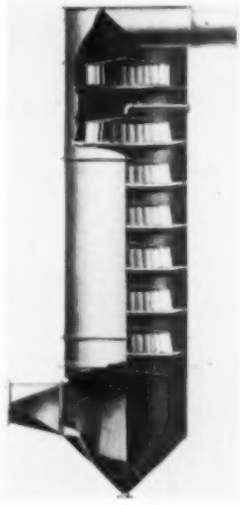
Unit is adapted to cutting gates and risers from castings

The tank of this machine has a capacity of four gallons and is constructed of galvanized iron. A 100 degree Fahr. viscosity oil is broken into a fine conical spray with direct delivery to the floor without atmospheric vaporization. The spray of oil is delivered by a large inner compressed air chamber, cast bronze oil pump which is always primed, and a check valve of ball type, in combination with an oil-resisting pressure hose, automatic shutoff valve, and brass extension rod with foundry oil spray nozzle.

Universal Wheel & Abrasive Co., 1330 West Jackson boulevard, Chicago, has been incorporated to market sharpening stones, grinding wheels, etc., by Robert H. Olson, Margaret Hyde, and Stephen Kauth.

Wet Dust Collector Tower Has New Features

Through an error in proof reading, the illustration presented on page 100 of the February, 1936 issue of THE FOUNDRY in connection with a description of design changes made in the line of dust collectors of the Claude B. Schneible Co., 3951 Lawrence Ave., Chicago, was presented upside down. This wet type collector tower, which is shown in the accompanying illustration, is similar in external appearance to former model, but now it is made with six dust impingement plates.



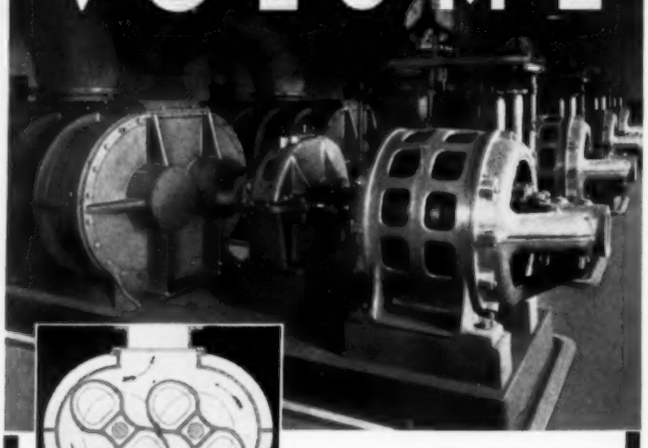
Collector has six dust impingement plates

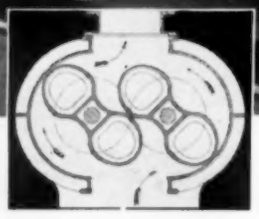
Portable Sander Has Increased Power

Black & Decker Mfg. Corp., Towson, Md., has redesigned its line of portable sanders, one of which is shown in the accompanying illustration. Power has been increased and the housing restyled, reducing both size and weight. New dust-proof construction is provided to eliminate wear. On the heavy-duty models the commutator and brush compartment is air-sealed and switches are dust-proof. Grease and labyrinth seals are included to keep dust and grease from gears and bearings. New slot type exhaust ports also are used.

Dust-proof construction is provided to eliminate wear

AIR IN MEASURED VOLUME





VARYING resistance to the flow through the charge in the cupola does not change the volume of air delivered when the blast is supplied by an "R-C" Rotary Positive Blower.

With each revolution of the impellers, a definite volume of air is forced into the cupola, requiring power in direct proportion to the pressure.

"R-C" Positive Displacement Blowers are helping assure continuous, profitable operation to America's most progressive foundries.

May we send you our new Foundry Bulletin, No. 22-B12.

Roots CONNERSVILLE BLOWER CORP.

CONNERSVILLE, INDIANA

"TOMORROW'S ENGINEERING APPROVED BY YESTERDAY'S EXPERIENCE"

For the ENTIRE field of core manufacture

CORDIP

• For the dipping or spraying of dry or green sand cores, whether large or small in size, or a hard or soft coating desired—CORDIP, the prepared corewash, treats all alike—resulting in cleaner, smoother castings with minimum cleaning costs.

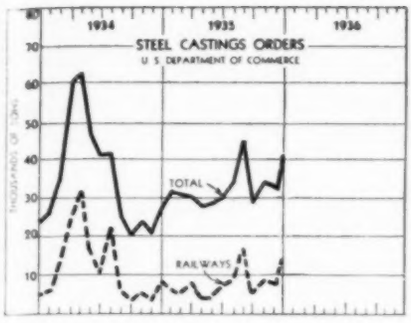
Let us send a liberal sample

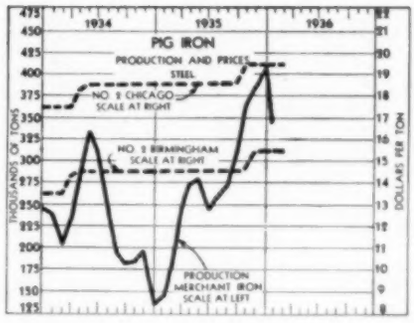
THE UNITED STATES GRAPHITE CO.

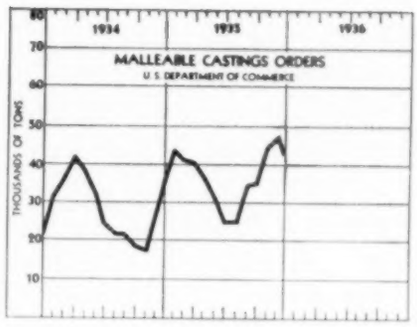
SAGINAW MICHIGAN

Manufacturers of Mexican Graphite Products since 1891

PLUMBAGO
BLACKING
CARBON RAISING GRAPHITE
GRAPHITE GREASES
MOTOR AND GENERATOR BRUSHES
SELF LUBRICATING BEARINGS
WELDING CARBONS







Foundry Activities

Reflect Industrial Trends

FOUNDRY operations in the Chicago district tended upward in February. While production of automotive castings continued at a restricted rate, farm implement and tractor plants were busier. Some tractor manufacturers have been running at capacity, while average schedules of the industry were the best since 1929. Road machinery manufacturers are experiencing brisk operations. Steel foundries are receiving better business in railroad castings. Foundry coke shipments last month were the heaviest for that period in several years.

* * *

Michigan Valve & Foundry Corp., 3631 Parkinson avenue, Detroit, has been incorporated.

* * *

Starr Bros. Bell Co. foundry, East Hampton, Conn., was damaged by fire recently, causing $4000 loss.

* * *

Union Iron Works is making plans for the construction of a foundry in Union, S. C., to cost approximately $37,000 with equipment.

* * *

Chesapeake & Ohio railroad, Terminal tower, Cleveland, suffered damage to its pattern shop in Barboursville, W. Va., recently, E. L. Bock is general superintendent.

* * *

Circuit Judge T. T. Jacobs, Coldwater, Mich., has dissolved the receivership under which the Homer Furnace & Foundry Co., Coldwater, has operated since 1932.

* * *

Maynard Electric Steel Castings Co., 2820 South Twenty-seventh street, Milwaukee, has built several large steel propellers for use in Mississippi river freight service. Weighing 5000 pounds each, the four blades are nine feet in diameter and each blade is four feet wide.

* * *

Lakeside Welding Co. has been granted a lease, with option to purchase, on the former plant of the Gluntz Brass Foundry Co. Inc., located on 55th street, Cleveland.

* * *

Assets of Vulcan Wheels Inc., Avenue L and Thornton street, Newark, N. J., have been purchased by the American Brake Shoe & Foundry Co., Avenue L and Edward street, Newark, N. J. The Vulcan Wheels division of the American Brake Shoe & Foundry Co. has been organized to carry on the business formerly conducted by Vulcan Wheels Inc. The same staff will be maintained.

* * *

Klamath Iron Works, Klamath Falls, Oreg., has been incorporated to do a general foundry and machine shop business, by W. H. Beane, David R. Vandenberg, and William Ganong.

* * *

Atlas Foundry & Machinery Co., Tacoma, Wash., has been granted a permit to construct a craneway trestle at 3012 South Wilkeson street.

* * *

Commercial Iron Works, Houston, Tex., has been granted a state charter for the manufacture of iron. Incorporators are Cyrus R. Cotton, John L. Barnes, and Calvin B. Garwood.

* * *

Art Brass Foundry Inc., 506 South Green street, Chicago, has been incorporated to do a general foundry and machine business, by Oscar A. Hansen, and Helen and Goodman E. Olson.

* * *

Pacific Steel Foundry Co., Eighteenth and Treat streets, San Francisco, plans installation of mechanical handling apparatus and power equipment, in addition to rebuilding the plant damaged by fire.

* * *

Inter-State Foundry Co., Inc., 3823 Massachusetts avenue, Indianapolis, has been organized to do a general foundry business by Leo R. Meyer, William F. McGlasson, and James E. Rocap, resident agent.

* * *

Lynchburg Foundry Co. Inc., Lynchburg, Va., plans construction of a new shop at Radford, Va., at a cost of $420,000. The building will

RAW MATERIAL PRICES
March 4, 1936

Iron	
No. 2 foundry, Valley	$19.50
No. 2 Southern, Birmingham	15.50
No. 2 foundry, Chicago	19.50
No. 2 foundry, Buffalo	19.50
Basic, Buffalo	18.50
Basic, Valley	19.00
Malleable, Chicago	19.50
Malleable, Buffalo	20.00
Charcoal iron, furnace	22.00
Coke	
Connellsville beehive premium	$5.50
Wise county beehive coke	$4.30 to 5.00
Detroit by-product coke	9.00
Scrap	
Heavy melting steel, Valley	$16.00 to $16.50
Heavy melting steel, Pitts.(dlv.)	15.50 to 16.00
Heavy melting steel, Chicago	14.50 to 15.00
Stove plate, Buffalo	11.00 to 11.50
Stove plate, Chicago	8.50 to 9.00
No. 1 cast, New York	9.75 to 10.00
No. 1 cast, mchy., Chicago	13.50 to 14.00
No. 1 cast, Pittsburgh	14.00 to 14.50
No. 1 cast, Philadelphia	13.50 to 14.00
No. 1 cast, Birmingham	11.00 to 12.00
Car wheels, iron, Pittsburgh	14.50 to 15.00
Car wheels, iron, Chicago	14.50 to 15.00
Railroad malleable, Chicago	18.00 to 18.50
Malleable, Buffalo	15.75 to 16.25
Nonferrous Metals	**Cents per pound**
Castings copper, refinery	8.95 to 9.00
Straits tin	48.25
Aluminum, 99 per cent	19.00 to 21.00
Aluminum, No. 12 (Secondary, standard)	16.75 to 17.25
Lead, New York	4.60
Antimony, New York	13.25
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	4.90

be 372 feet long and will house casting, cleaning, and annealing departments. Pipe will be cast by the centrifugal process. New machinery is to be installed. C. Harold Owen is secretary.

* * *

Brost Pattern & Casting Co., Cleveland, has been incorporated by Harry E. Smoyer, W. K. Stanley, and M. E. Schuttenberg. Stanley & Smoyer, 970 Union Trust building, Cleveland, is correspondent.

* * *

Elwood Pattern Works Inc., 125 North East street, Indianapolis, has been incorporated to manufacture photographical supplies, by Elwood C. Rogers, Anna M. Rogers, and Paula Hawkins.

* * *

Baroda Gray Iron Foundry has been incorporated by directors Kurt Weber, Baroda, Mich., Amalie Weber, Alex Kamber, Enrich Weber, St. Joseph, Mich., and Attorney Arthur E. Lackner, Benton Harbor, Mich.

* * *

Canton Foundry & Machine Co., Canton, O., has moved its offices from the Dime Bank building, Canton, to the factory at 6400 Breakwater avenue, Cleveland. The company is a division of the Hill Clutch Machine & Foundry Co., Cleveland.

* * *

Fire damaged the main assembly building of the K. R. Wilson Foundry, Liberty street, Arcade, N. Y., recently, resulting in a loss estimated between $150,000 and $200,000. Kirke R. Wilson, 295 Depew avenue, Buffalo, is owner of the company.

* * *

American Steel Foundries Inc., 1000 East Broadway, Alliance, O., recently increased production to meet rush orders for railroad equipment and tire molds. The plant, previously working three days a week, has brought its operations up to a five-day schedule.

* * *

Index of foundry equipment orders, compiled by the Foundry Equipment Manufacturers' association, 1213 West Third street, Cleveland, and based on contributions from 22 companies in the association, was 127 in January, 1936, compared to 118.1 in December, 1935, and 86.6 in January, 1935. Index shipments was 110.4 and unfilled orders, 107.5.

* * *

Norristown Foundry Co., Norristown, Pa., now under new management, has purchased the foundry and machine shop properties at Elm and Harry streets, Conshohocken, Pa., formerly owned and operated by the Electromelt Co. With improvements and additions to buildings and the installation of new equipment, the plant will be operated as a general jobbing gray iron foundry. William S. Thomas is president and general manager of the new company.

NEW Trade Publications

CONVEYORS—Mathews Conveyor Co., Ellwood City, Pa., presents an attractive 56-page booklet entitled "Problems Solved," giving a range and variety of typical situations and problems. Using a principle that all efficient production is a series of functional sequences based upon the ideal of a continuous flow, the company has set forth an impressive array of examples of how this ideal has been carried out with satisfaction in various industries. Of particular interest is that application to the foundries using these conveyor systems.

HEATERS—Fedders Mfg. Co., Buffalo, has published a folder announcing the addition of seven sizes to its line of Series 3 unit heaters. Features of construction are illustrated.

PNEUMATIC TUBE SYSTEMS—Standard Conveyor Co., North St. Paul, Minn., has published a catalog on its line of pneumatic tube systems. Illustrations show a wide variety of uses.

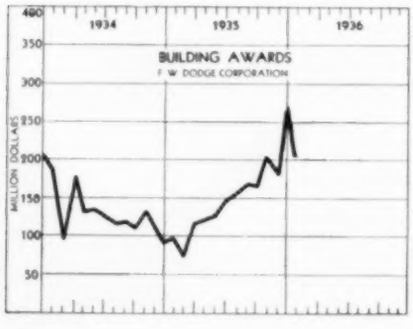
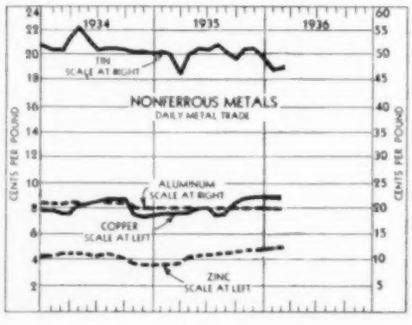
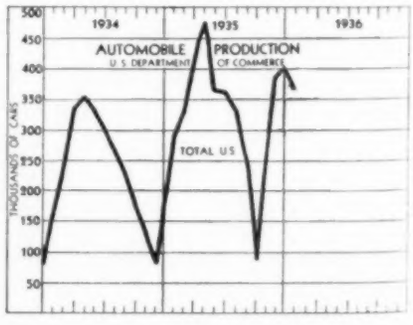
CONTROL EQUIPMENT—Brown Instrument Co., Philadelphia, has published a catalog on its air operated controllers for temperature, pressure, flow and liquid level. Features of construction are described and illustrated.

CONVEYORS—Gravity roller conveyors are described in detail and illustrated with drawings and reproductions of photographs in a recent catalog of the Standard Conveyor Co., North St. Paul, Minn. Various foundry uses are included.

PUMPS—Air cushion valve vacuum pumps are described and illustrated in a recent bulletin of the Pennsylvania Pump & Compressor Co., Easton, Pa. That company also has published a bulletin on its centrifugal pumps, double suction, single stage and sleeve bearing.

VALVES—Hancock Valve division, Consolidated Ashcroft Hancock Co. Inc., Bridgeport, Conn., has published a well-illustrated bulletin on its line of valves. The seat and disk of the valve are featured, with a gamma ray photograph showing the construction.

HANDLING EQUIPMENT—Palmer-Bee Co., Westminster and G. T. R. R., Detroit, has published a 288-page booklet on its bulk material handling machinery. Various types of elevators and conveyors, applicable to foundry handling problems, are illustrated and described in this catalog.

REPAIR WELDING—Linde Air Products Co., 30 East Forty-second street, New York, has published a booklet presenting information regarding the repair of damaged cast iron machinery by the oxyacetylene welding process. The booklet discusses the applications for which the respective processes of bronze welding and fusion welding are best suited.

FLUX—Mathieson Alkali Works, 60 East Forty-second street, New York, recently has published an interesting and instructive booklet entitled "Purite's Place in Foundry Practice." The text explains the action of Purite in the cupola and methods of using, action in the forehearth and methods of application in the forehearth or teapot ladle.